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**RESULTS OF THE SEPTEMBER 19-20, 2011
RELATIVE ACCURACY TEST AUDIT
OF THE SO₂/NO_x/CO₂ CEM SYSTEM INSTALLED
ON THE NO. 9 BOILER (S10) OUTLET DUCT
AT THE MANITOWOC PUBLIC UTILITIES
FACILITY IN MANITOWOC, WISCONSIN**

Submitted to:

Mechanical Systems Inc.
480 Progress Way
Sun Prairie, WI 53590

Attention:

Rocky Orzechowski

Reviewed by:



Kathleen Eickstadt
Coordinator
Source Testing

Report Number 11-30312(No. 9)
October 25, 2011
DVH

TABLE OF CONTENTS

ABBREVIATIONS.....	iii
1 INTRODUCTION.....	1
2 SUMMARY AND DISCUSSION	2

APPENDICES:

- A - Sampling Train Calibration Data
- B - Field Data Sheets
- C - Reference Method Computer Printouts
- D - Measurement Systems Performance Specifications
- E - Calibration Gas Certification Sheets
- F - Gas Analyzer Specifications
- G - CEM Instrument Information Sheets
- H - CEM Computer Printouts
- I - Procedures
- J - Calculation Equations

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	Diameter
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/ 10^6 BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/dscm	milligrams per dry standard cubic meter
ug/dscm	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 °F (20 °C) and 29.92 IN. of mercury pressure

1 INTRODUCTION

On September 19-20, 2011, Interpoll Laboratories personnel conducted a Relative Accuracy Test Audit (RATA) on the following Continuous Emission Monitoring (CEM) Systems installed on the Boiler 9 Outlet Duct (S10) at the Manitowoc Public Utilities Facility in Manitowoc, Wisconsin:

Monitor				
Type	Manufacturer	Model	Serial No.	Location
SO2	Thermo Electron	43i	43i0510511567	No. 9 Boiler
NOx	Thermo Electron	42i	42i0510511561	No. 9 Boiler
CO2	Thermo Electron	41i	410i0510511584	No. 9 Boiler
Flow	United Sciences	150	1500188	No. 9 Boiler

On-site testing was performed by Rory Ebynck and Andrew Strong. Coordination between testing activities and plant operation was provided by Jake Jensen of Mechanical Systems, Inc. The test was not witnessed by a representative of the Wisconsin Department of Natural Resources.

The RATA was performed in accordance with EPA Methods 3A, 6C, and 7E, CFR Title 40, Part 60, Appendix A (revised July 1, 2011) and per Part 75. For oxygen analysis, a slip stream of sample gas was withdrawn from the exhaust gas stream using test ports (provided by the plant) on the stack adjacent to the CEMS using a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the oxygen analyzer with the excess exhausted to the atmosphere through a calibrated orifice which was used to ensure that the flow from the stack exceeds the requirements of the analyzer. For SO₂, NO_x, and CO₂ analysis, a dilution probe based system was used. In this system a slip stream of exhaust gas is drawn from the exhaust gas stream using an M&C dilution probe. The sample stream is filtered and diluted (approximate dilution during these tests was 100:1) before delivery to the SO₂, NO_x and CO₂ analyzers. The analog response of the analyzers in both systems was recorded using a computer data logger and backed up with a strip chart recorder. The analyzers were calibrated with EPA Protocol gases.

The important results of the test are summarized in the following tables. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The results of the Relative Accuracy Test Certification are summarized in the following tables. An overview of the results is presented below:

NO. 9 BOILER RELATIVE ACCURACY RESULTS

Parameter	Units	Measured
NO _x	LB/10 ⁶ BTU	3.77
NO _x	ppm,w	1.80
SO ₂	ppm,w	0.58
SO ₂	LB/10 ⁶ BTU	2.41
CO ₂	% v/v,w	1.99
Flow (172 klbs)	SCFH	2.89
Flow (300 klbs)	SCFH	2.06

No difficulties were encountered in the field or in the evaluation of the data. On the basis of these facts and a complete review of the data and results, it is our opinion that the CO₂, SO₂ and NO_x concentrations reported herein are accurate and closely reflect the actual values, which existed at the time the test was performed.

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit
 of the NOx Analyzer Installed on the No. 9 Boiler Breeching at the
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 Klbs/Hr

Run	Date	Time			Nox Lbs/mmBTU		
		RM	CEM	DIFF.			
1	09/19/11	23:00	-	23:20	0.072	0.070	0.002
2	09/19/11	23:35	-	23:55	0.078	0.076	0.002
3	09/20/11	0:10	-	0:30	0.084	0.084	0.000
4	* 09/20/11	0:45	-	1:05	0.081	0.077	0.004
5	09/20/11	1:20	-	1:40	0.082	0.079	0.003
6	09/20/11	1:55	-	2:15	0.088	0.086	0.002
7	09/20/11	2:30	-	2:50	0.090	0.088	0.002
8	09/20/11	3:10	-	3:30	0.087	0.084	0.003
9	09/20/11	3:45	-	4:05	0.092	0.089	0.003
10	09/20/11	4:20	-	4:40	0.090	0.086	0.004
Average Diff.				0.085	0.082	0.002333	
Standard Deviation						0.001	
Confidence Coefficient						0.000859	
Relative Accuracy						3.77	
Bias Test						Fail	
Bias Adjustment Factor						1.028	
* Run was not used in Relative Accuracy calculation							
RM = Reference Method							
CEM = Continuous Emission Monitor							

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit of the NOx Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 KIbs/Hr

Run	Date	Time	Nox ppm, wet		
			RM	CEM	DIFF.
1	09/19/11	23:00 - 23:20	35.00	34.80	0.20
2	09/19/11	23:35 - 23:55	37.70	37.30	0.40
3	09/20/11	0:10 - 0:30	40.40	40.80	-0.40
4	09/20/11	0:45 - 1:05	38.30	37.10	1.20
5	09/20/11	1:20 - 1:40	38.80	37.80	1.00
6	09/20/11	1:55 - 2:15	41.10	41.20	-0.10
7	09/20/11	2:30 - 2:50	41.60	41.50	0.10
8	09/20/11	3:10 - 3:30	40.30	40.20	0.10
9	09/20/11	3:45 - 4:05	42.00	41.60	0.40
10	* 09/20/11	4:20 - 4:40	41.00	39.60	1.40
Average Diff.			39.467	39.144	0.322
Standard Deviation					0.507
Confidence Coefficient					0.389635
Relative Accuracy					1.80
Bias Test					Pass
Bias Adjustment Factor					1.008
* Run was not used in Relative Accuracy calculation					
RM = Reference Method					
CEM = Continuous Emission Monitor					

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit of the SO₂ Analyzer Installed on the No. 9 Boiler Breeching at the Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 KIbs/Hr

Run	Date	Time	SO₂ ppm, wet		
			RM	CEM	DIFF.
1	09/19/11	23:00 - 23:20	95.00	95.90	-0.90
2	09/19/11	23:35 - 23:55	95.70	96.20	-0.50
3	09/20/11	0:10 - 0:30	86.40	86.30	0.10
4	09/20/11	0:45 - 1:05	93.20	93.40	-0.20
5	09/20/11	1:20 - 1:40	88.90	88.20	0.70
6	09/20/11	1:55 - 2:15	76.80	77.40	-0.60
7	* 09/20/11	2:30 - 2:50	87.30	86.40	0.90
8	09/20/11	3:10 - 3:30	90.30	90.00	0.30
9	09/20/11	3:45 - 4:05	87.20	87.60	-0.40
10	09/20/11	4:20 - 4:40	101.70	101.10	0.60
Average Diff.			90.578	90.678	-0.100000
Standard Deviation					0.557
Confidence Coefficient					0.427975
Relative Accuracy					0.58
Bias Test					Pass
Bias Adjustment Factor					0.999

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit
 of the SO₂ Analyzer Installed on the No. 9 Boiler Breeching at the
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 KIbs/Hr

Run	Date	Time		SO ₂ Lbs/mmBTU		
				RM	CEM	DIFF.
1	09/19/11	23:00	-	0.271	0.270	0.001
2	09/19/11	23:35	-	0.276	0.273	0.003
3	09/20/11	0:10	-	0.250	0.246	0.004
4	09/20/11	0:45	-	0.276	0.271	0.005
5	09/20/11	1:20	-	0.262	0.255	0.007
6	09/20/11	1:55	-	0.228	0.223	0.005
7	* 09/20/11	2:30	-	0.263	0.255	0.008
8	09/20/11	3:10	-	0.270	0.263	0.007
9	09/20/11	3:45	-	0.265	0.260	0.005
10	09/20/11 *	4:20	-	0.311	0.304	0.007
Average Diff.				0.268	0.263	0.004889
Standard Deviation						0.002
Confidence Coefficient						0.001559
Relative Accuracy						2.41
Bias Test						Fail
Bias Adjustment Factor						1.019

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit
 on the CO₂ Analyzer Installed on the No. 9 Boiler Breeching at the
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 KIbs/Hr

Run	Date	Time			CO ₂ , wet Summary		
		RM	CEM	DIFF.			
1	09/19/11	23:00	-	23:20	10.70	10.80	-0.10
2	09/19/11	23:35	-	23:55	10.60	10.70	-0.10
3	09/20/11	0:10	-	0:30	10.50	10.70	-0.20
4	09/20/11	0:45	-	1:05	10.30	10.50	-0.20
5	09/20/11	1:20	-	1:40	10.30	10.50	-0.20
6	* 09/20/11	1:55	-	2:15	10.30	10.60	-0.30
7	09/20/11	2:30	-	2:50	10.10	10.30	-0.20
8	09/20/11	3:10	-	3:30	10.20	10.40	-0.20
9	09/20/11	3:45	-	4:05	10.00	10.20	-0.20
10	09/20/11	4:20	-	4:40	10.00	10.10	-0.10
Average Difference				10.300	10.467	-0.16667	
Standard Deviation						0.050	
Confidence Coefficient						0.038433	
Relative Accuracy						1.99	
Bias Test						Pass	
Bias Adjustment Factor						0.984	

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Summary of the Results of the September 19-20, 2011, Relative Accuracy Test Audit
 on the Flow Analyzer Installed on the No. 9 Boiler Breeching at the
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

172 Klbs/Hr

Flow (SCFH) Summary					
Run	Date	Time	RM	CEM	DIFF.
1	09/19/11	23:00 - 23:10	5,054,000	4,940,712	113,289
2	* 09/19/11	23:35 - 23:45	5,086,000	4,863,136	222,864
3	09/20/11	0:10 - 0:20	5,044,000	4,839,741	204,259
4	09/20/11	0:45 - 0:55	4,988,000	4,849,315	138,685
5	09/20/11	1:20 - 1:30	4,976,000	4,833,750	142,250
6	09/20/11	1:55 - 2:05	4,909,000	4,862,908	46,092
7	09/20/11	2:30 - 2:40	4,855,000	4,787,029	67,971
8	09/20/11	3:10 - 3:20	4,943,000	4,870,518	72,482
9	09/20/11	3:45 - 3:55	4,809,000	4,883,778	-74,778
10	09/20/11	4:20 - 4:30	4,839,000	4,846,620	-7,620
Average Difference			4935222.222	4857152.078	78070.14444
Standard Deviation					84275.128
Confidence Coefficient					64779.481756
Relative Accuracy					2.89
Bias Test					Fail
Bias Adjustment Factor					1.016

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

Results of the September 20th, 2011 Relative Accuracy Test Audit
 of the Flow Analyzer Installed on the No. 9 Boiler Breeching at the
 Manitowoc Public Utilities Plant located in Manitowoc, Wisconsin.

300 KIbs/Hr

Flow (SCFH)

Run	Date	Time		RM	CEM	DIFF.
1	09/20/11	6:55	-	6,716,000	6,886,889	-170,889
2	09/20/11	7:02	-	6,668,000	6,767,752	-99,752
3	09/20/11	7:08	-	6,693,000	6,787,875	-94,875
4	* 09/20/11	7:25	-	6,648,000	6,820,057	-172,057
5	09/20/11	7:31	-	6,834,000	6,825,414	8,586
6	09/20/11	7:38	-	6,840,000	6,770,704	69,296
7	09/20/11	7:55	-	6,721,000	6,830,224	-109,224
8	09/20/11	8:01	-	6,773,000	6,889,048	-116,048
9	09/20/11	8:07	-	6,751,000	6,898,136	-147,136
10	09/20/11	8:13	-	6,826,000	6,897,977	-71,977

Average Diff. 6758000.000 6839335.400 -81335.400

Confidence Coefficient 58108.203120

Standard Deviation 75596.101

Relative Accuracy 2.06

Bias Test Pass

Bias Adjustment Factor 0.988107704

* Run was not used in Relative Accuracy calculation

RM = Reference Method

CEM = Continuous Emission Monitor

APPENDIX A

SAMPLING EQUIPMENT CALIBRATION DATA

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Stack Sampling Department - QA
Field Barometer Calibration Sheet

Date: 4/14/2011
Technician: Rory Eynck
Mercury Column Barometer Number: Weighing Room Barometer
Aneroid Barometer Number: Ultimeter #3 (Rory's)

Reference Mercury Barometer Reading	Ambient Temperature	Temperature Correction Factor	Adjusted Mercury Barometer Reading	Initial Field Barometer Reading	Difference ($P_{ba} - P_{bm}$)
29.36	76	0.132	29.23	29.24	0.012

Weighing room barometer setup:

- 1) Using the set screw on the bottom of the barometer, adjust the level of the mercury reservoir to the point that the level indicator makes slight contact with the mercury. A flashlight can aid in seeing the dimple formed when the level indicator makes contact with the mercury.
- 2) Slide the measurement ruler on the barometer to the point where the bottom of the ruler is in line with the top of the mercury column's reverse meniscus. Record the reading (in. Hg)
- 3) Take a temperature reading and record the temperature correction factor from the lookup table near the barometer.
- 4) Apply the temperature correction factor to the mercury barometer.
- 5) Adjust the field barometer reading to within +/- 0.1 in. Hg of the reference barometer reading.

Has this barometer shown any consistent problems with calibration? Has the problem been alleviated? _____

Note: Aneroid barometers will be calibrated periodically against a mercury column barometer. The aneroid barometer to be calibrated should be placed in close proximity to the mercury barometer and left to equilibrate for 20 - 30 minutes before calibrating. Aneroid barometer will be calibrated to the adjusted mercury barometer readings.

Alternative Calibration Procedure:

- 1) Obtain the station value or absolute barometric pressure P_r from a nearby National Weather Service station and its elevation (A) in feet above sea level.
- 2) Determine the elevation (B) in feet above sea level of the site of the field barometer.(local airport)
- 3) Calculate the site barometric pressure (P_b) as follows:
$$P_b = P_r + 0.001 (A-B)$$
- 4) Compare the field barometer reading against P_b obtained in step 3.
- 5) Adjust the field barometer reading to within +/- 0.1 in. Hg.

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Temperature Measurement Device Calibration Sheet

Unit under Test:

Vendor	CEN-TECH	Serial Number	5183648
Model	92242	Thermocouple Type	Type K
Range	0-2100 °F	Technician	Rory Eiynck
Date of Calibration	4/14/2011	PDT Number	109

Method of Calibration:

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 °F) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δt (°F)	%
0	1	1	0.217
100	98	2	0.357
200	203	3	0.455
300	299	1	0.132
400	398	2	0.233
500	497	3	0.313
600	599	1	0.094
700	695	5	0.431
800	798	2	0.159
900	896	4	0.294
1000	999	1	0.068
1100	1098	2	0.128
1200	1198	2	0.120
1300	1299	1	0.057
1400	1398	2	0.108
1500	1498	2	0.102
1600	1598	2	0.097
1700	1695	5	0.231
1800	1794	6	0.265
1900	1894	6	0.254
2000	1996	4	0.163
2100			
	Average:	3	0.204

OF = off scale response by unit under test (oF)

% dev = $100\Delta t / (460 + t)$

Unit was in tolerance
(Must be within +/- 1.5% absolute reference temperature)

Unit was not in tolerance : Recalibrated see new calibration sheet or
unit put out of service.

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Temperature Measurement Device Calibration Sheet

Unit under Test:

Vendor	Omega	Serial Number	201108
Model	hh-81	Thermocouple Type	Type K
Range	0-2100 °F	Technician	Rory Elynck
Date of Calibration	4/14/2011	PDT Number	85

Method of Calibration:

Omega Model CL-300 Type K Thermocouple Simulator which provides 22 precise temperature equivalent millivolt signals. The CL-300 is cold junction compensated. Calibration accuracy is +/- 0.1 % of span(2100 °F) +/- 1 degree (for negative temperatures add +/- 2 degrees). The CL-300 simulated exactly the millivoltage of a Type K thermocouple at the indicated temperature.

Desired Temp. (°F) Nominal	Response of Unit Under Test (°F)	Deviation	
		Δt (°F)	%
0	2	2	0.435
100	101	1	0.179
200	205	5	0.758
300	302	2	0.263
400	402	2	0.233
500	500	0	0.000
600	603	3	0.283
700	699	1	0.086
800	803	3	0.238
900	901	1	0.074
1000	1004	4	0.274
1100	1103	3	0.192
1200	1204	4	0.241
1300	1304	4	0.227
1400	1404	4	0.215
1500	1504	4	0.204
1600	1605	5	0.243
1700	1702	2	0.093
1800	1800	0	0.000
1900	1901	1	0.042
2000			
2100	OF		
	Average:	3	0.214

OF = off scale response by unit under test (OF)

% dev = $100 \Delta t / (460 + t)$

Unit was in tolerance

Unit was not in tolerance : Recalibrated see new calibration sheet or

(Must be within +/- 1.5% absolute reference temperature)



Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

Customer: **Interpoll Laboratories**

S-type Pitot ID: **04-5+P1** Date: **10-May-11**
Standard Pitot ID: **001** Personnel: **WB**
Cp(std): **0.99** Cp(actual): **0.816**
Part Number: P(bar): **29.50**
Test Velocity (fps): **30 - 60 - 90** T(°F): **63**

Calibration Results				
Velocity (fps)	Nominal ΔP_s [inches H ₂ O]	Cp _(s) A-Side	Cp _(s) B-Side	Cp _(s) Average
30	0.304	0.810	0.809	0.810
60	1.148	0.821	0.817	0.819
90	2.649	0.820	0.819	0.819
Overall Average				0.816

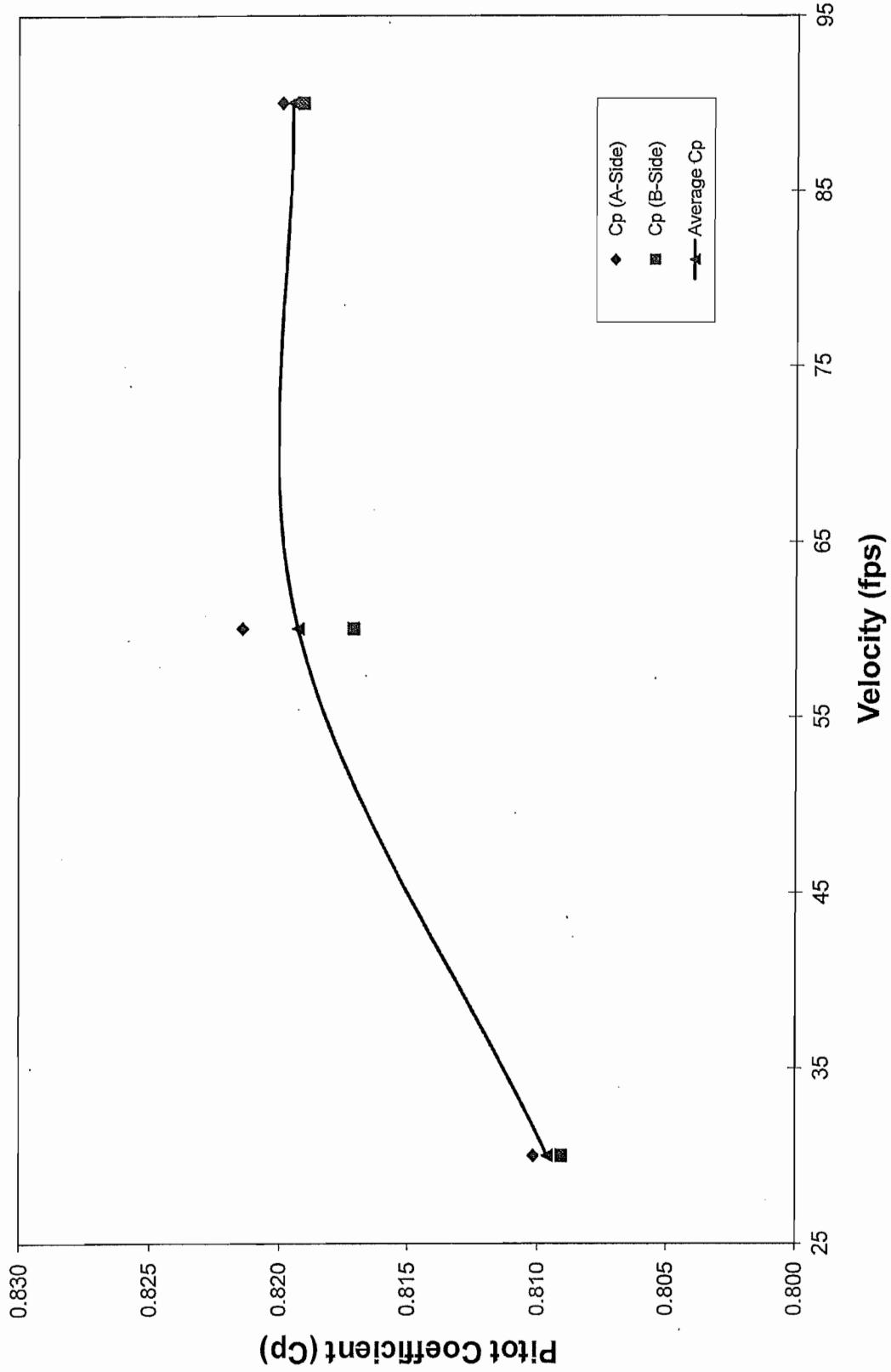
Pitot tube S/N 04-5+P1 was calibrated in accordance with the Code of Federal Regulations, Title 40, Part 60 Appendix A, Method 2, Section 10.

Signature

Date

S-Type Pitot (S/N 04-5+P1) - Pitot Coefficient (Cp) vs Velocity (fps)

Environmental Supply Company Wind Tunnel - 5/11/2011





Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **10-May-11**Standard Pitot ID: **001** Personnel: **WB**Cp(std): **0.99** Cp(actual): **0.810**Part Number: P(bar): **29.50**Test Velocity (fps): **30** T(°F): **63**

A-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
0.203	0.305	0.807	-0.003
0.203	0.300	0.814	0.004
0.204	0.301	0.815	0.005
0.201	0.304	0.805	-0.005
AVERAGE		0.810	0.004
		Std deviation	0.005

B-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
0.203	0.306	0.806	-0.003
0.204	0.304	0.810	0.001
0.205	0.306	0.811	0.002
0.203	0.305	0.809	0.000
AVERAGE		0.809	0.001
		Std deviation	0.002

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.001} \text{ [must be } < 0.010 \text{]}$$

*Deviation = {Cp(s) - AVG Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.



Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **10-May-11**Standard Pitot ID: **001** Personnel: **WB**Cp(std): **0.99** Cp(actual): **0.819**Part Number: P(bar): **29.50**Test Velocity (fps): **60** T(°F): **63**

A-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
0.782	1.152	0.816	-0.006
0.787	1.142	0.822	0.001
0.786	1.143	0.821	0.000
0.789	1.130	0.827	0.006
AVERAGE		0.821	0.003
		Std deviation	0.005

B-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
0.789	1.150	0.820	0.003
0.785	1.150	0.818	0.001
0.785	1.164	0.813	-0.004
0.786	1.151	0.818	0.001
AVERAGE		0.817	0.002
		Std deviation	0.003

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.004} \text{ [must be } < 0.010 \text{]}$$

*Deviation = {Cp(s) - AVG Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.



Environmental Supply Company, Inc.

Quality Source Sampling Systems & Accessories

Wind Tunnel Pitot Calibration

S-type Pitot ID: **04-5+P1** Date: **10-May-11**
Standard Pitot ID: **001** Personnel: **WB**
Cp(std): **0.99** Cp(actual): **0.819**
Part Number: P(bar): **29.50**
Test Velocity (fps): **90** T(°F): **63**

A-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
1.824	2.644	0.822	0.002
1.811	2.639	0.820	0.000
1.815	2.645	0.820	0.000
1.802	2.646	0.817	-0.003
AVERAGE		0.820	0.001
		Std deviation	0.002

B-SIDE

ΔP_{std} (in. H ₂ O)	ΔP_s (in. H ₂ O)	Cp(s)	Deviation*
1.821	2.659	0.819	0.000
1.809	2.655	0.817	-0.002
1.817	2.655	0.819	0.000
1.821	2.649	0.821	0.002
AVERAGE		0.819	0.001
		Std deviation	0.001

$$Cp(s) = Cp(std) \sqrt{\frac{\Delta P(std)}{\Delta P(s)}}$$

$$Cp(A) - Cp(B) = \boxed{0.001} \text{ [must be } < 0.010 \text{]}$$

*Deviation = {Cp(s) - AVG Cp(s)} {must be <0.010}

Standard deviation of the deviations must be less than 0.02 for both

Pitot tube S/N 04-5+P1 was calibrated in accordance with the CFR 40, Part 60 Appendix A, Method 2, Section 10.

APPENDIX B

FIELD DATA SHEETS

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	1N	Run	1	Date	9/19-20/2011
Stack Diameter (in.)		108			
Dry Bulb (°F)	331		Wet Bulb (°F)	126	
Moisture Content (%)			6.50		
Monometer			Normal		
Barometric Pressure			29.36		
Static Pressure +/-			-0.68		
Operators	RE / JH / AS				
Pitot No.	04-5+-P1		Pitot Coeff.	0.815	

172 Klbs/Hr

Interpoli Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU		
Source	No. 9 Boiler		
Test	1N	Run	Date
Stack Diameter (in.)		2	9/19-20/2011
Dry Bulb (°F)		108	
Moisture Content (%)	326	Wet Bulb (°F)	126
Monometer		6.64	
Barometric Pressure		Normal	
Static Pressure +/-		29.36	
Operators		-0.65	
Pitot No.	RE / JH / AS		
	04-5+-P1	Pitot Coeff.	0.815

Cross-section View Elevation View

Elevation View

172 Klbs/Hr

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU					
Source	No. 9 Boiler					
Test	1N	Run	3	Date	9/19-20/2011	
Stack Diameter (in.)		108				
Dry Bulb (°F)	324		Wet Bulb (°F)		126	
Moisture Content (%)				6.62		
Monometer			Normal			
Barometric Pressure			29.36			
Static Pressure +/-			-0.68			
Operators	RE / JH / AS					
Pitot No.	04-5+-P1		Pitot Coeff.		0.815	

Interpoll Laboratories
(763) 786-6020

Interpoll Laboratories
(763) 786-6020

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	1N	Run	6	Date
Stack Diameter (in.)		108		9/19-20/2011
Dry Bulb (°F)	324		Wet Bulb (°F)	127
Moisture Content (%)				7.06
Monometer				Normal
Barometric Pressure				29.36
Static Pressure +/-				-0.66
Operators				RE / JH / AS
Pitot No.	04-5+-P1		Pitot Coeff.	0.815

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	1N	Run	7	Date	
Stack Diameter (in.)	108				
Dry Bulb (°F)	325	Wet Bulb (°F)	128		
Moisture Content (%)	7.50				
Monometer	Normal				
Barometric Pressure	29.36				
Static Pressure +/-	-0.66				
Operators	RE / JH / AS				
Pitot No.	04-5+-P1		Pitot Coeff.	0.815	
172 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	2:30 AM
A-1	0.032	3.46	14.96	0.200	325
A-2	0.105	11.34	22.84	0.230	325
A-3	0.194	20.95	32.45	0.240	325
A-4	0.323	34.88	46.38	0.210	325
A-5	0.677	73.12	84.62	0.210	325
A-6	0.806	87.05	98.55	0.260	325
A-7	0.895	96.66	108.16	0.250	325
A-8	0.968	104.54	116.04	0.270	325
B-1				0.200	323
B-2				0.190	323
B-3				0.260	323
B-4				0.220	323
B-5				0.210	323
B-6				0.250	323
B-7				0.280	323
B-8				0.290	323
Digital Numbers Used:		85 / 109	End Time:	2:40 AM	

Interpoll Laboratories
(763) 786-6020

**Interpoll Laboratories
(763) 786-6020**

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	1N	Run	9	Date	9/19-20/2011
Stack Diameter (in.)	108				
Dry Bulb (°F)	329		Wet Bulb (°F)	128	
Moisture Content (%)			7.30		
Monometer			Normal		
Barometric Pressure			29.36		
Static Pressure +/-			-0.68		
Operators	RE / JH / AS				
Pitot No.	04-5+-P1		Pitot Coeff.	0.815	
					Cross-section View
					Elevation View

172 Klbs/Hr

Digital Numbers Used:

85 / 109

End Time:

3:55 AM

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	1N	Run	10	Date
Stack Diameter (in.)			108	9/19-20/2011
Dry Bulb (°F)	325		Wet Bulb (°F)	126
Moisture Content (%)				6.53
Monometer				Normal
Barometric Pressure				29.36
Static Pressure +/-				-0.68
Operators	RE / JH / AS			
Pitot No.	04-5+-P1		Pitot Coeff.	0.815

172 Klbs/Hr

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job Source	MSI / Manitowoc PU			
Test	No. 9 Boiler			
Stack Diameter (in.)	Test 1M	Run 1	Date 9/20/2011	
Dry Bulb (°F)			108	
Moisture Content (%)	329		Wet Bulb (°F) 129	
Monometer			7.73	
Barometric Pressure			Fluid	
Static Pressure +/-			29.38	
Operators			-0.36	
Pitot No.	04-5+-P1		RE / JH / AS	
			Pitot Coeff. 0.8150	

300 Klbs/Hr

Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	6:55 AM
A-1	0.032	3.46	14.96	0.440	329
A-2	0.105	11.34	22.84	0.430	329
A-3	0.194	20.95	32.45	0.430	329
A-4	0.323	34.88	46.38	0.400	329
A-5	0.677	73.12	84.62	0.390	329
A-6	0.806	87.05	98.55	0.480	329
A-7	0.895	96.66	108.16	0.580	329
A-8	0.968	104.54	116.04	0.690	329
B-1				0.480	330
B-2				0.480	330
B-3				0.480	330
B-4				0.470	330
B-5				0.420	330
B-6				0.380	330
B-7				0.390	330
B-8				0.420	330
Digital Numbers Used:	85 / 109			End Time:	7:01 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job Source	MSI / Manitowoc PU				
Test	No. 9 Boiler				
Stack Diameter (in.)	Test 1M	Run 2	Date 9/20/2011		
Dry Bulb (°F)		108			
Moisture Content (%)	331	Wet Bulb (°F)	129		
Monometer			7.66		
Barometric Pressure		Fluid			
Static Pressure +/-		29.38			
Operators		-0.40			
Pitot No.	04-5+-P1	RE / JH / AS			
		Pitot Coeff.	0.8150		
300 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50		Start Time: 7:02 AM
A-1	0.032	3.46	14.96	0.440	331
A-2	0.105	11.34	22.84	0.460	331
A-3	0.194	20.95	32.45	0.410	331
A-4	0.323	34.88	46.38	0.410	331
A-5	0.677	73.12	84.62	0.400	331
A-6	0.806	87.05	98.55	0.460	331
A-7	0.895	96.66	108.16	0.550	331
A-8	0.968	104.54	116.04	0.620	331
B-1				0.530	332
B-2				0.490	332
B-3				0.490	332
B-4				0.470	332
B-5				0.340	332
B-6				0.390	332
B-7				0.380	332
B-8				0.430	332
Digital Numbers Used:		85 / 109		End Time:	7:07 AM

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU			
Source	No. 9 Boiler			
Test	Test 1M	Run	3	Date
Stack Diameter (in.)			108	9/20/2011
Dry Bulb (°F)	329		Wet Bulb (°F)	129
Moisture Content (%)			7.74	
Monometer			Fluid	
Barometric Pressure			29.38	
Static Pressure +/-			-0.42	
Operators			RE / JH / AS	
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU		
Source	No. 9 Boiler		
Test	Test 1M	Run	4
Stack Diameter (in.)		Date	9/20/2011
Dry Bulb (°F)	330	Wet Bulb (°F)	131
Moisture Content (%)		8.60	
Monometer		Fluid	
Barometric Pressure		29.38	
Static Pressure +/-		-0.39	
Operators	RE / JH / AS		
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU		
Source	No. 9 Boiler		
Test	Test 1M	Run	5
Stack Diameter (in.)		Date	9/20/2011
Dry Bulb (°F)	333	Wet Bulb (°F)	108
Moisture Content (%)		8.49	131
Monometer		Fluid	
Barometric Pressure		29.38	
Static Pressure +/-		-0.41	
Operators	RE / JH / AS		
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	Test 1M	Run	6		
Stack Diameter (in.)		Date	9/20/2011		
Dry Bulb (°F)	334	Wet Bulb (°F)	108		
Moisture Content (%)			8.45		
Monometer			Fluid		
Barometric Pressure			29.38		
Static Pressure +/-			-0.41		
Operators	RE / JH / AS				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		
				300 Klbs/Hr	
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	7:38 AM
A-1	0.032	3.46	14.96	0.450	334
A-2	0.105	11.34	22.84	0.480	334
A-3	0.194	20.95	32.45	0.460	334
A-4	0.323	34.88	46.38	0.390	334
A-5	0.677	73.12	84.62	0.400	334
A-6	0.806	87.05	98.55	0.470	334
A-7	0.895	96.66	108.16	0.570	334
A-8	0.968	104.54	116.04	0.630	333
B-1				0.580	333
B-2				0.510	333
B-3				0.490	333
B-4				0.460	333
B-5				0.430	333
B-6				0.430	333
B-7				0.430	333
B-8				0.460	333
Digital Numbers Used:			85 / 109	End Time:	7:43 AM

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	Test 1M	Run	7	Date	9/20/2011
Stack Diameter (in.)	108				
Dry Bulb (°F)	335	Wet Bulb (°F)	132	Cross-section View	Elevation View
Moisture Content (%)	8.88				
Monometer	Fluid				
Barometric Pressure	29.38				
Static Pressure +/-	-0.40				
Operators	RE / JH / AS				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150	300 Klbs/Hr	
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
Port Length (in.): 11.50				Start Time:	7:55 AM
A-1	0.032	3.46	14.96	0.470	335
A-2	0.105	11.34	22.84	0.420	335
A-3	0.194	20.95	32.45	0.430	335
A-4	0.323	34.88	46.38	0.400	335
A-5	0.677	73.12	84.62	0.420	335
A-6	0.806	87.05	98.55	0.460	335
A-7	0.895	96.66	108.16	0.570	335
A-8	0.968	104.54	116.04	0.620	335
B-1				0.500	336
B-2				0.480	336
B-3				0.480	336
B-4				0.420	336
B-5				0.440	336
B-6				0.400	336
B-7				0.420	336
B-8				0.450	336
Digital Numbers Used: 85 / 109 End Time: 8:00 AM					

Interpoll Laboratories
(763) 786-6020
EPA Method 2 Field Data Sheet

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	Test 1M	Run	9	Date	
Stack Diameter (in.)			108	9/20/2011	
Dry Bulb (°F)	335	Wet Bulb (°F)	132		
Moisture Content (%)			8.88		
Monometer		Fluid			
Barometric Pressure		29.38			
Static Pressure +/-		-0.40			
Operators	RE / JH / AS				
Pitot No.	04-5+-P1	Pitot Coeff.	0.8150		
300 Klbs/Hr					
Traverse Point Number	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)	Velocity	Temperature of Gas (°F)
		Port Length (in.):	11.50	Start Time:	8:07 AM
A-1	0.032	3.46	14.96	0.430	335
A-2	0.105	11.34	22.84	0.480	335
A-3	0.194	20.95	32.45	0.440	335
A-4	0.323	34.88	46.38	0.400	335
A-5	0.677	73.12	84.62	0.410	335
A-6	0.806	87.05	98.55	0.460	335
A-7	0.895	96.66	108.16	0.560	335
A-8	0.968	104.54	116.04	0.660	335
B-1				0.490	333
B-2				0.520	333
B-3				0.460	333
B-4				0.450	333
B-5				0.420	333
B-6				0.400	333
B-7				0.420	333
B-8				0.440	333
Digital Numbers Used:			85 / 109	End Time:	8:12 AM

Interpoll Laboratories
(763) 786-6020

Job	MSI / Manitowoc PU				
Source	No. 9 Boiler				
Test	Test 1M	Run	10	Date	9/20/2011
Stack Diameter (in.)			108		
Dry Bulb (°F)	334		Wet Bulb (°F)	132	
Moisture Content (%)			8.91		
Monometer			Fluid		
Barometric Pressure			29.38		
Static Pressure +/-			-0.39		
Operators	RE / JH / AS				
Pitot No.	04-5+-P1		Pitot Coeff.	0.8150	
			Cross-section		Elevation
			View		View

APPENDIX C

REFERENCE METHOD COMPUTER PRINTOUTS

MSI / Manitowoc PU

Manitowoc, WI

No. 9 Boiler

9/20/2011

Run 1-3

<u>Time</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
6:55:47	6.329	13.236
6:56:47	6.493	13.093
6:57:47	6.434	13.155
6:58:47	6.468	13.161
6:59:47	6.336	13.273
7:00:47	6.383	13.275
7:01:47	6.21	13.193
7:02:47	5.844	13.176
7:03:47	5.795	13.218
7:04:47	5.899	13.124
7:05:47	5.901	13.117
7:06:47	5.955	13.223
7:07:47	6.475	13.212
7:08:47	6.44	13.17
7:09:47	6.29	13.259
7:10:47	5.76	13.331
7:11:47	5.674	13.304
7:12:47	5.751	13.199
7:13:47	5.755	13.217
7:14:47	5.76	13.215
7:15:47	6.092	13.346
Average	6.097	13.214

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M
300 KIbs/Hr

Run 1

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.440	0.663	329	6:55 AM
2	A-2	0.430	0.656	329	
3	A-3	0.430	0.656	329	
4	A-4	0.400	0.632	329	
5	A-5	0.390	0.624	329	
6	A-6	0.480	0.693	329	
7	A-7	0.580	0.762	329	
8	A-8	0.690	0.831	329	
9	B-1	0.480	0.693	330	
10	B-2	0.480	0.693	330	
11	B-3	0.480	0.693	330	
12	B-4	0.470	0.686	330	
13	B-5	0.420	0.648	330	
14	B-6	0.380	0.616	330	
15	B-7	0.390	0.624	330	
16	B-8	0.420	0.648	330	7:01 AM
Average		0.460	0.676	330	

Moisture Content Data

	<u>Flow Rate Data</u>
Dry Bulb (°F)	329
Wet Bulb (°F)	129.0
TRA	1.14
Vapor Pressure of Water	4.41
ZT	200.00
PM	227.04
Barometric Pressure	29.38
Standard Meter Volume	
Moisture Content	7.73
O ₂ %	6.07
CO ₂ %	14.413
Standard CFH	6,716,433
K Standard CFH	111.941
<u>Molecular Weight (dry)</u>	
Molecular Weight (wet)	
Stack Pressure	
Feet per Second	
Actual CFM	
DSCFM	
Stack Area (ft ²)	
Stack Diameter (in.)	
Duct Width (in.)	
Duct Length (in.)	
Duct Area (ft ²)	
Molecular Weight (dry)	
Molecular Weight (wet)	
Stack Pressure	
Feet per Second	
Actual CFM	
DSCFM	
63.6173	
108.0	
0.0	
0.0	
0.0	
30.549	
29.578	
29.354	
44.697	
170610.96	
103282.29	

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	6.10	0.03	11.03	11.00	6.07 dry
CO ₂ (wet)	13.21	0.01	8.47	8.52	13.30 wet
Moisture	7.73				
Fuel Factor C	1840				
DSCFM	103282				
Standard CFH					6,716,433
K Standard CFM					111.941

Results

Start Time	6:55 AM
Stop Time	7:01 AM
Standard CFH	6,716,000
CO ₂ %, wet	13.30
WAF applied	0.9950

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.440	0.663	331	
2	A-2	0.460	0.678	331	
3	A-3	0.410	0.640	331	
4	A-4	0.410	0.640	331	
5	A-5	0.400	0.632	331	
6	A-6	0.460	0.678	331	
7	A-7	0.550	0.742	331	
8	A-8	0.620	0.787	331	
9	B-1	0.530	0.728	332	
10	B-2	0.490	0.700	332	
11	B-3	0.490	0.700	332	
12	B-4	0.470	0.686	332	
13	B-5	0.340	0.583	332	
14	B-6	0.390	0.624	332	
15	B-7	0.380	0.616	332	
16	B-8	0.430	0.656	332	7:07 AM
Average		0.454	0.672	332	

Moisture Content Data

Dry Bulb (°F)	331	<u>Flow Rate Data</u>	
Wet Bulb (°F)	129.0	Static Pressure	-0.40
TRA	1.14	Pilot Coefficient	0.82
Vapor Pressure of Water	4.41		
ZT	202.00	Duct Width (in.)	0.00
PM	224.92	Duct Length (in.)	0.00
Barometric Pressure	29.38	Duct Area (ft ²)	0.00
Standard Meter Volume		Stack Diameter (in.)	108.00
Moisture Content	7.66	Stack Area (ft ²)	63.62
O ₂ %	6.057	Molecular Weight (dry)	30.549
CO ₂ %	14.418	Molecular Weight (wet)	29.588
Standard CFH	6,667,678	Stack Pressure	29.351
K Standard CFH	111.128	Feet per Second	44.49
		Actual CFM	169818.57
		DSCFM	102611.82

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	6.10	0.04	11.04	11.00	6.06 dry
CO ₂ (wet)	13.21	0.01	8.46	8.52	13.31 wet
Moisture	7.66				
Fuel Factor C	1840				
DSCFM	102612				
Standard CFH					6,667,678
K Standard CFM					111.128

Results

<u>Start Time</u>	7:02 AM
<u>Stop Time</u>	7:07 AM
<u>Standard CFH</u>	6,668,000
<u>CO₂ %, wet</u>	13.31
<u>WAF applied</u>	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M Run 3
300 KIbs/Hr

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.450	0.671	329	
2	A-2	0.490	0.700	329	
3	A-3	0.430	0.656	329	
4	A-4	0.400	0.632	329	
5	A-5	0.410	0.640	329	
6	A-6	0.440	0.663	329	
7	A-7	0.550	0.742	329	
8	A-8	0.600	0.775	329	
9	B-1	0.520	0.721	332	
10	B-2	0.470	0.686	332	
11	B-3	0.480	0.693	332	
12	B-4	0.430	0.656	332	
13	B-5	0.410	0.640	332	
14	B-6	0.420	0.648	332	
15	B-7	0.400	0.632	332	
16	B-8	0.400	0.632	332	7:14 AM
Average		0.456	0.674	331	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		329	<u>Flow Rate Data</u>		
Wet Bulb (°F)		129.0	Static Pressure	-0.42	
TRA		1.14	Pitot Coefficient	0.815	
Vapor Pressure of Water		4.41			
ZT		200.00	Duct Width (in.)	0.00	
PM		227.07	Duct Length (in.)	0.00	
Barometric Pressure		29.38	Duct Area (ft ²)	0.00	
Standard Meter Volume			Stack Diameter (in.)	108.00	
Moisture Content		7.74	Stack Area (ft ²)	63.62	
O ₂ %		6.057	Molecular Weight (dry)	30.551	
CO ₂ %		14.43	Molecular Weight (wet)	29.58	
Standard CFH		6,692,531	Stack Pressure	29.349	
K Standard CFH		111.542	Feet per Second	44.601	
			Actual CFM	170244.7	
			DSCFM	102912.21	

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	6.10	0.04	11.04	11.00	6.06 dry
CO ₂ (wet)	13.21	0.01	8.46	8.52	13.31 wet
Moisture	7.74				
Fuel Factor C	1840				
DSCFM	102912				

Results

<u>Start Time</u>	7:08 AM
<u>Stop Time</u>	7:14 AM
<u>Standard CFH</u>	6,693,000
<u>CO₂ %, wet</u>	13.31
<u>WAF applied</u>	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/20/2011
Run 4-6

<u>Time</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
7:25:57	5.65	13.366
7:26:57	5.599	13.426
7:27:57	5.653	13.371
7:28:57	5.643	13.453
7:29:57	5.624	13.452
7:30:57	5.636	13.373
7:31:57	5.695	13.32
7:32:57	5.702	13.404
7:33:57	5.675	13.405
7:34:57	5.739	13.377
7:35:57	5.739	13.335
7:36:57	5.722	13.394
7:37:57	5.655	13.435
7:38:57	5.676	13.407
7:39:57	5.67	13.434
7:40:57	5.599	13.513
7:41:57	5.642	13.487
7:42:57	5.658	13.496
7:43:57	5.666	13.457
7:44:57	5.69	13.415
7:45:57	5.745	13.329
Average	5.670	13.412

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M Run 4
300 KIbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.480	0.693	330	
2	A-2	0.440	0.663	330	
3	A-3	0.430	0.656	330	
4	A-4	0.420	0.648	330	
5	A-5	0.380	0.616	330	
6	A-6	0.460	0.678	330	
7	A-7	0.540	0.735	330	
8	A-8	0.640	0.800	330	
9	B-1	0.480	0.693	332	
10	B-2	0.520	0.721	332	
11	B-3	0.420	0.648	332	
12	B-4	0.430	0.656	332	
13	B-5	0.390	0.624	332	
14	B-6	0.380	0.616	332	
15	B-7	0.390	0.624	332	
16	B-8	0.400	0.632	332	7:30 AM
Average		0.450	0.669	331	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	330	
Wet Bulb (°F)	131.0	Static Pressure
TRA	1.14	Pitot Coefficient
Vapor Pressure of Water	4.65	
ZT	199.00	Duct Width (in.)
PM	252.32	Duct Length (in.)
Barometric Pressure	29.38	Duct Area (ft ²)
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	8.60	Stack Area (ft ²)
O ₂ %	5.638	Molecular Weight (dry)
CO ₂ %	14.734	Molecular Weight (wet)
Standard CFH	6,648,494	Stack Pressure
K Standard CFH	110.808	Feet per Second
		Actual CFM
		DSCFM
		63.6172512
		30.583
		29.501
		29.351
		44.333
		169218.76
		101282.51

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	5.67	0.04	11.03	11.00	5.64 dry
CO ₂ (wet)	13.41	0.00	8.49	8.52	13.47 wet
Moisture	8.60				
Fuel Factor C	1840				
DSCFM	101283				
Standard CFH					6,648,494
K Standard CFM					110.808

Results

Start Time	7:25 AM
Stop Time	7:30 AM
Standard CFH	6,648,000
CO ₂ %, wet	13.47
WAF applied	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M Run 5
300 KIbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.490	0.700	333	7:31 AM
2	A-2	0.480	0.693	333	
3	A-3	0.460	0.678	333	
4	A-4	0.420	0.648	333	
5	A-5	0.390	0.624	333	
6	A-6	0.460	0.678	333	
7	A-7	0.580	0.762	333	
8	A-8	0.620	0.787	333	
9	B-1	0.510	0.714	335	
10	B-2	0.550	0.742	335	
11	B-3	0.480	0.693	335	
12	B-4	0.470	0.686	335	
13	B-5	0.410	0.640	335	
14	B-6	0.410	0.640	335	
15	B-7	0.420	0.648	335	
16	B-8	0.480	0.693	335	7:37 AM
Average		0.477	0.689	334	

Moisture Content Data

Dry Bulb (°F)	333	<u>Flow Rate Data</u>	
Wet Bulb (°F)	131.0	Static Pressure	-0.41
TRA	1.14	Pitot Coefficient	0.815
Vapor Pressure of Water	4.65		
ZT	202.00	Duct Width (in.)	0
PM	249.13	Duct Length (in.)	0
Barometric Pressure	29.38	Duct Area (ft ²)	0
Standard Meter Volume		Stack Diameter (in.)	108
Moisture Content	8.49	Stack Area (ft ²)	63.6172512
O ₂ %	5.646	Molecular Weight (dry)	30.573
CO ₂ %	14.667	Molecular Weight (wet)	29.505
Standard CFH	6,834,490	Stack Pressure	29.35
K Standard CFH	113.908	Feet per Second	45.748
		Actual CFM	174621.25
		DSCFM	104239.47

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	5.67	0.03	11.02	11.00	5.65 dry
CO ₂ (wet)	13.41	-0.01	8.51	8.52	13.42 wet
Moisture	8.49				
Fuel Factor C	1840				
DSCFM	104239				
Standard CFH	6,834,000				6,834,490
K Standard CFM	113.908				

Results

Start Time	7:31 AM
Stop Time	7:37 AM
Standard CFH	6,834,000
CO ₂ %, wet	13.42
WAF applied	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M
300 KIbs/Hr

Run 6

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.450	0.671	334	7:38 AM
2	A-2	0.480	0.693	334	
3	A-3	0.460	0.678	334	
4	A-4	0.390	0.624	334	
5	A-5	0.400	0.632	334	
6	A-6	0.470	0.686	334	
7	A-7	0.570	0.755	334	
8	A-8	0.630	0.794	333	
9	B-1	0.580	0.762	333	
10	B-2	0.510	0.714	333	
11	B-3	0.490	0.700	333	
12	B-4	0.460	0.678	333	
13	B-5	0.430	0.656	333	
14	B-6	0.430	0.656	333	
15	B-7	0.430	0.656	333	
16	B-8	0.460	0.678	333	7:43 AM
Average		0.478	0.690	333	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	334	
Wet Bulb (°F)	131.0	Static Pressure -0.41
TRA	1.14	Pitot Coefficient 0.815
Vapor Pressure of Water	4.65	
ZT	203.00	Duct Width (in.) 0.00
PM	248.06	Duct Length (in.) 0.00
Barometric Pressure	29.38	Duct Area (ft ²) 0.00
Standard Meter Volume		Stack Diameter (in.) 108.00
Moisture Content	8.45	Stack Area (ft ²) 63.62
O ₂ %	5.646	Molecular Weight (dry) 30.572
CO ₂ %	14.661	Molecular Weight (wet) 29.509
Standard CFH	6,840,210	Stack Pressure 29.35
K Standard CFH	114.004	Feet per Second 45.754
		Actual CFM 174643.59
		DSCFM 104368.23

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	5.67	0.03	11.02	11.00	5.65 dry
CO ₂ (wet)	13.41	-0.01	8.51	8.52	13.42 wet
Moisture	8.45				
Fuel Factor C	1840				
DSCFM	104368				
					Standard CFH 6,840,210
					K Standard CFM 114.004

Results

<u>Start Time</u>	7:38 AM
<u>Stop Time</u>	7:43 AM
<u>Standard CFH</u>	6,840,000
<u>CO₂ %, wet</u>	13.42
<u>WAF applied</u>	0.9950

MSI / Manitowoc PU

Manitowoc, WI

No. 9 Boiler

9/20/2011

Run 7-9

<u>Time</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
7:55:07	5.636	13.373
7:56:07	5.66	13.374
7:57:07	5.674	13.375
7:58:07	5.689	13.338
7:59:07	5.711	13.344
8:00:07	5.647	13.37
8:01:07	5.603	13.456
8:02:07	5.629	13.405
8:03:07	5.597	13.431
8:04:07	5.634	13.372
8:05:07	5.678	13.3
8:06:07	5.706	13.353
8:07:07	5.685	13.34
8:08:07	5.747	13.29
8:09:07	5.806	13.288
8:10:07	5.693	13.404
8:11:07	5.628	13.4
8:12:07	5.661	13.375
8:13:07	5.656	13.36
8:14:07	5.658	13.362
8:15:07	5.7	13.349
8:16:07	5.768	13.302
8:17:07	5.774	13.255
8:18:07	5.697	13.326
8:19:07	5.723	13.367
Average	5.682	13.356

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M
300 KIbs/Hr

Run 7

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.470	0.686	335	
2	A-2	0.420	0.648	335	
3	A-3	0.430	0.656	335	
4	A-4	0.400	0.632	335	
5	A-5	0.420	0.648	335	
6	A-6	0.460	0.678	335	
7	A-7	0.570	0.755	335	
8	A-8	0.620	0.787	335	
9	B-1	0.500	0.707	336	
10	B-2	0.480	0.693	336	
11	B-3	0.480	0.693	336	
12	B-4	0.420	0.648	336	
13	B-5	0.440	0.663	336	
14	B-6	0.400	0.632	336	
15	B-7	0.420	0.648	336	
16	B-8	0.450	0.671	336	8:00 AM
Average		0.461	0.678	336	

Moisture Content Data

Dry Bulb (°F)	335	<u>Flow Rate Data</u>	
Wet Bulb (°F)	132.0	Static Pressure	-0.40
TRA	1.14	Pitot Coefficient	0.815
Vapor Pressure of Water	4.78		
ZT	203.00	Duct Width (in.)	0.00
PM	260.57	Duct Length (in.)	0.00
Barometric Pressure	29.38	Duct Area (ft ²)	0.00
Standard Meter Volume		Stack Diameter (in.)	108.00
Moisture Content	8.88	Stack Area (ft ²)	63.62
O ₂ %	5.658	Molecular Weight (dry)	30.58
CO ₂ %	14.709	Molecular Weight (wet)	29.463
Standard CFH	6,721,192	Stack Pressure	29.351
K Standard CFH	112.02	Feet per Second	45.073
		Actual CFM	172046.59
		DSCFM	102074.93

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O ₂ (dry)	5.68	0.03	11.02	11.0	5.66	dry
CO ₂ (wet)	13.36	0.00	8.49	8.5	13.40	wet
Moisture	8.88				6,721,192	
Fuel Factor C	1840				112.02	
DSCFM	102075					

Results

Start Time	7:55 AM
Stop Time	8:00 AM
Standard CFH	6,721,000
CO ₂ %, wet	13.40
WAF applied	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M
300 Klbs/Hr

Run 8

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.450	0.671	336	
2	A-2	0.480	0.693	336	
3	A-3	0.450	0.671	336	
4	A-4	0.400	0.632	336	
5	A-5	0.400	0.632	336	
6	A-6	0.440	0.663	336	
7	A-7	0.540	0.735	336	
8	A-8	0.630	0.794	336	
9	B-1	0.530	0.728	335	
10	B-2	0.530	0.728	335	
11	B-3	0.450	0.671	335	
12	B-4	0.500	0.707	335	
13	B-5	0.430	0.656	335	
14	B-6	0.380	0.616	335	
15	B-7	0.430	0.656	335	
16	B-8	0.460	0.678	335	8:06 AM
Average		0.469	0.683	336	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	336	
Wet Bulb (°F)	132.0	
TRA	1.14	Static Pressure
Vapor Pressure of Water	4.78	Pitot Coefficient
ZT	204.00	Duct Width (in.)
PM	259.51	Duct Length (in.)
Barometric Pressure	29.38	Duct Area (ft ²)
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	8.84	Stack Area (ft ²)
O ₂ %	5.658	Molecular Weight (dry)
CO ₂ %	14.745	Molecular Weight (wet)
Standard CFH	6,772,808	Stack Pressure
K Standard CFH	112.88	Feet per Second
		Actual CFM
		DSCFM
		173376.53
		102899.01

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	5.68	0.03	11.02	11.0	5.66 dry
CO ₂ (wet)	13.36	0.01	8.47	8.5	13.44 wet
Moisture	8.84				6,772,808
Fuel Factor C	1840				112.88
DSCFM	102899				

Results

Start Time	8:01 AM
Stop Time	8:06 AM
Standard CFH	6,773,000
CO ₂ %, wet	13.44
WAF applied	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M
300 Kibs/Hr

Run 9

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.430	0.656	335	
2	A-2	0.480	0.693	335	
3	A-3	0.440	0.663	335	
4	A-4	0.400	0.632	335	
5	A-5	0.410	0.640	335	
6	A-6	0.460	0.678	335	
7	A-7	0.560	0.748	335	
8	A-8	0.660	0.812	335	
9	B-1	0.490	0.700	333	
10	B-2	0.520	0.721	333	
11	B-3	0.460	0.678	333	
12	B-4	0.450	0.671	333	
13	B-5	0.420	0.648	333	
14	B-6	0.400	0.632	333	
15	B-7	0.420	0.648	333	
16	B-8	0.440	0.663	333	8:12 AM
Average		0.465	0.680	334	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	335	
Wet Bulb (°F)	132.0	Static Pressure
TRA	1.14	Pitot Coefficient
Vapor Pressure of Water	4.78	
ZT	203.00	Duct Width (in.)
PM	260.57	Duct Length (in.)
Barometric Pressure	29.38	Duct Area (ft ²)
Standard Meter Volume		Stack Diameter (in.)
Moisture Content	8.88	Stack Area (ft ²)
O ₂ %	5.658	Molecular Weight (dry)
CO ₂ %	14.751	Molecular Weight (wet)
Standard CFH	6,751,470	Stack Pressure
K Standard CFH	112.525	Feet per Second
		Actual CFM
		DSCFM
		172495.77
		102534.77

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>	
O ₂ (dry)	5.68	0.03	11.02	11.0	5.66	dry
CO ₂ (wet)	13.36	0.01	8.47	8.5	13.44	wet
Moisture	8.88					
Fuel Factor C	1840					
DSCFM	102535					

Results

Start Time	8:07 AM
Stop Time	8:12 AM
Standard CFH	6,751,000
CO ₂ %, wet	13.44
WAF applied	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/20/2011
Run 10

Time	%O₂, d	% CO₂, w
7:55:07	5.636	13.373
7:56:07	5.66	13.374
7:57:07	5.674	13.375
7:58:07	5.689	13.338
7:59:07	5.711	13.344
8:00:07	5.647	13.37
8:01:07	5.603	13.456
8:02:07	5.629	13.405
8:03:07	5.597	13.431
8:04:07	5.634	13.372
8:05:07	5.678	13.3
8:06:07	5.706	13.353
8:07:07	5.685	13.34
8:08:07	5.747	13.29
8:09:07	5.806	13.288
8:10:07	5.693	13.404
8:11:07	5.628	13.4
8:12:07	5.661	13.375
8:13:07	5.656	13.36
8:14:07	5.658	13.362
8:15:07	5.7	13.349
8:16:07	5.768	13.302
8:17:07	5.774	13.255
8:18:07	5.697	13.326
8:19:07	5.723	13.367
Average	5.682	13.356

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/20/2011
1M Run 10
300 KIbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.480	0.693	334	
2	A-2	0.480	0.693	334	
3	A-3	0.440	0.663	334	
4	A-4	0.430	0.656	334	
5	A-5	0.430	0.656	334	
6	A-6	0.450	0.671	334	
7	A-7	0.520	0.721	334	
8	A-8	0.650	0.806	334	
9	B-1	0.510	0.714	336	
10	B-2	0.470	0.686	336	
11	B-3	0.490	0.700	336	
12	B-4	0.450	0.671	336	
13	B-5	0.450	0.671	336	
14	B-6	0.420	0.648	336	
15	B-7	0.450	0.671	336	
16	B-8	0.480	0.693	336	8:19 AM
Average		0.475	0.688	335	

Moisture Content Data

	<u>Flow Rate Data</u>
Dry Bulb (°F)	334
Wet Bulb (°F)	132.0
TRA	1.14
Vapor Pressure of Water	4.78
ZT	202.00
PM	261.63
Barometric Pressure	29.38
Standard Meter Volume	
Moisture Content	8.91
O ₂ %	5.658
CO ₂ %	14.756
Standard CFH	6,825,805
K Standard CFH	113.763
<u>Molecular Weight (dry)</u>	
<u>Molecular Weight (wet)</u>	
<u>Stack Pressure</u>	
<u>Feet per Second</u>	
<u>Actual CFM</u>	
<u>DSCFM</u>	

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	5.68	0.03	11.02	11.0	5.66 dry
CO ₂ (wet)	13.36	0.01	8.47	8.5	13.44 wet
Moisture	8.91				
Fuel Factor C	1840				
DSCFM	103623				
<u>Standard CFH</u>		<u>K Standard CFM</u>		<u>6,825,805</u>	
				<u>113.763</u>	

Results

<u>Start Time</u>	8:13 AM
<u>Stop Time</u>	8:19 AM
<u>Standard CFH</u>	6,826,000
<u>CO₂ %, wet</u>	13.44
<u>WAF applied</u>	0.9950

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 1

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
11:00:17	92.748	35.446	9.008	10.641
11:01:17	98.495	34.597	8.979	10.622
11:02:17	101.12	34.058	8.933	10.677
11:03:17	99.864	34.2	8.998	10.641
11:04:17	97.631	35.767	9.075	10.611
11:05:17	97.748	34.907	9.005	10.664
11:06:17	98.862	34.643	9.033	10.625
11:07:17	95.225	34.632	9.192	10.514
11:08:17	93.674	34.154	9.323	10.416
11:09:17	96.247	33.534	9.346	10.42
11:10:17	100.174	33.437	9.167	10.577
11:11:17	96.542	33.976	9.093	10.671
11:12:17	94.447	34.734	9.234	10.526
11:13:17	96.39	33.045	8.979	10.752
11:14:17	94.157	34.465	8.898	10.836
11:15:17	92.997	34.836	8.933	10.836
11:16:17	94.737	35.116	9.001	10.761
11:17:17	90.647	36.372	9.026	10.743
11:18:17	88.669	36.621	9.01	10.738
11:19:17	89.101	37.282	9.101	10.699
11:20:17	86.558	39.047	9.211	10.574
Average	95.049	34.994	9.074	10.645

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19/2011
Test 1N
Run 1
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta_p</u>	<u>Sq. root delta_p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.280	0.529	331	11:00 PM
2	A-2	0.310	0.557	331	
3	A-3	0.310	0.557	331	
4	A-4	0.250	0.500	331	
5	A-5	0.220	0.469	331	
6	A-6	0.220	0.469	331	
7	A-7	0.230	0.480	331	
8	A-8	0.230	0.480	331	
9	B-1	0.380	0.616	326	
10	B-2	0.330	0.574	326	
11	B-3	0.330	0.574	326	
12	B-4	0.240	0.490	326	
13	B-5	0.210	0.458	326	
14	B-6	0.180	0.424	326	
15	B-7	0.210	0.458	326	
16	B-8	0.230	0.480	326	11:10 PM
Average		0.260	0.507	329	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	329	
Wet Bulb (°F)	126.0	Static Pressure
TRA	1.15	Pitot Coefficient
Vapor Pressure of Water	4.07	
ZT	202.50	Duct Width (In.)
PM	190.42	Duct Length (in.)
Barometric Pressure	29.36	Duct Area (ft ²)
Moisture Content	6.50	Stack Diameter (in.)
O ₂ %	9.051	Stack Area (ft ²)
CO ₂ %	11.394	
Standard CFH	5,053,898	Molecular Weight (dry)
K Standard CFH	84.232	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		DSCFM
		128407.02
		78759.37

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.07	0.04	11.02	11.00	9.05
CO ₂ (wet)	10.64	0.01	8.52	8.52	10.65
NOx (wet)	34.99	0.06	113.04	113.20	35.00
SO ₂ (wet)	95.05	0.26	114.45	114.40	94.97
Moisture	6.50				
Fuel Factor	1833				
DSCFM	78759				
				5,053,898	
				84.232	

Results

Start Stop	11:00 PM 11:10 PM	Gases Start Gases Stop	11:00 PM 11:20 PM
CO ₂ %, wet	10.7		
NOX ppm, wet	35.0		
NOx LB/mmBTU	0.072		
SO ₂ ppm, wet	95.0		
SO ₂ LB/mmBTU	0.271		
SCFH	5,054,000		
WAF applied	0.9950		

MSI / Manitowoc PU

Manitowoc, WI

No. 9 Boiler

9/19/2011

Run 2

<u>Time</u>	<u>SO₂, ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
11:35:37	91.359	37.175	9.001	10.495
11:36:37	89.401	38.345	8.991	10.519
11:37:37	90.139	39.134	9.022	10.52
11:38:37	90.103	38.681	9.005	10.494
11:39:37	97.605	36.53	8.967	10.533
11:40:37	100.937	35.319	8.963	10.524
11:41:37	100.347	36.565	8.898	10.574
11:42:37	98.043	37.572	8.92	10.554
11:43:37	96.425	37.577	9.012	10.482
11:44:37	93.653	38.483	9.122	10.392
11:45:37	94.065	38.162	9.083	10.414
11:46:37	97.895	37.053	9.003	10.485
11:47:37	98.633	37.425	9.054	10.466
11:48:37	100.85	37.013	9.042	10.465
11:49:37	99.131	36.748	9.013	10.488
11:50:37	94.701	38.396	9.012	10.498
11:51:37	94.07	38.406	9.007	10.512
11:52:37	92.738	38.706	9.075	10.44
11:53:37	94.172	37.852	8.996	10.522
11:54:37	94.381	37.231	8.905	10.597
11:55:37	92.28	37.786	8.904	10.594
Average	95.282	37.627	9.000	10.503

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19/2011
Test 1N
172 Kilbs/Hr

Run 2

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.260	0.510	326	11:35 PM
2	A-2	0.320	0.566	326	
3	A-3	0.260	0.510	326	
4	A-4	0.280	0.529	326	
5	A-5	0.240	0.490	326	
6	A-6	0.230	0.480	326	
7	A-7	0.240	0.490	326	
8	A-8	0.260	0.510	326	
9	B-1	0.330	0.574	323	
10	B-2	0.270	0.520	323	
11	B-3	0.250	0.500	323	
12	B-4	0.260	0.510	323	
13	B-5	0.190	0.436	323	
14	B-6	0.280	0.529	323	
15	B-7	0.270	0.520	323	
16	B-8	0.220	0.469	323	11:45 PM
Average		0.260	0.509	325	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		325	<u>Flow Rate Data</u>		
Wet Bulb (°F)		126.0	Static Pressure	-0.65	
TRA		1.15	Pitot Coefficient	0.815	
Vapor Pressure of Water		4.07			
ZT		198.50	Duct Width (in.)	0.00	
PM		194.67	Duct Length (in.)	0.00	
Barometric Pressure		29.36	Duct Area (ft ²)	0.00	
Moisture Content		6.64	Stack Diameter (in.)	108.00	
O ₂ %		8.992	Stack Area (ft ²)	63.62	
CO ₂ %		11.306			
Standard CFH		5,086,056	Molecular Weight (dry)	30.169	
K Standard CFH		84.768	Molecular Weight (wet)	29.36	
			Stack Pressure	29.312	
			Feet per Second	33.68	
			Actual CFM	128658.85	
			DSCFM	79137.95	

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.00	0.02	11.01	11.00	8.99
CO ₂ (wet)	10.50	0.01	8.48	8.52	10.56
NOx (wet)	37.63	0.04	112.89	113.20	37.71
SO ₂ (wet)	95.28	0.33	113.81	114.40	95.73
Moisture	6.64	<u>Standard CFH</u>		5,086,056	
Fuel Factor	1833	<u>K Standard CFM</u>		84.768	
DSCFM	79138				

Results

Start	11:35 PM	Gases Start	11:35 PM
Stop	11:45 PM	Gases Stop	11:55 PM
CO ₂ %, wet	10.6		
NOX ppm, wet	37.7		
NOx LB/mmBTU	0.078		
SO ₂ ppm, wet	95.7		
SO ₂ LB/mmBTU	0.276		
SCFH	5,086,000		
WAF applied	0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 3

<u>Time</u>	<u>SO₂ ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
12:10:47	88.928	38.472	8.968	10.566
12:11:47	89.615	38.406	8.863	10.66
12:12:47	91.802	38.233	8.872	10.636
12:13:47	92.865	37.598	8.837	10.684
12:14:47	90.032	39.388	8.931	10.621
12:15:47	88.694	39.302	9.01	10.567
12:16:47	88.242	38.666	8.952	10.592
12:17:47	87.245	38.986	9.005	10.571
12:18:47	85.882	40.324	9.098	10.464
12:19:47	85.261	40.446	9.13	10.428
12:20:47	82.56	40.97	9.153	10.43
12:21:47	83.511	41.489	9.205	10.346
12:22:47	81.782	41.601	9.136	10.421
12:23:47	70.857	42.877	9.123	10.459
12:24:47	79.346	41.875	9.192	10.373
12:25:47	83.374	42.552	9.317	10.257
12:26:47	85.246	42.216	9.317	10.235
12:27:47	87.748	41.59	9.318	10.234
12:28:47	88.765	41.448	9.315	10.222
12:29:47	88.064	41.534	9.315	10.219
12:30:47	84.122	41.453	9.328	10.243
Average	85.902	40.449	9.114	10.439

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 3
172 Kibs/Hr

Volumetric Flow Rate Data

Number of Sample Points

16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.390	0.624	324	
2	A-2	0.370	0.608	324	
3	A-3	0.360	0.600	324	
4	A-4	0.180	0.424	324	
5	A-5	0.210	0.458	324	
6	A-6	0.240	0.490	324	
7	A-7	0.230	0.480	324	
8	A-8	0.270	0.520	324	
9	B-1	0.270	0.520	326	
10	B-2	0.210	0.458	326	
11	B-3	0.230	0.480	326	
12	B-4	0.200	0.447	326	
13	B-5	0.220	0.469	326	
14	B-6	0.220	0.469	326	
15	B-7	0.260	0.510	326	
16	B-8	0.270	0.520	326	12:20 AM
Average		0.258	0.505	325	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		325	<u>Flow Rate Data</u>		
Wet Bulb (°F)		126.0	Static Pressure	-0.68	
TRA		1.15	Pilot Coefficient	0.815	
Vapor Pressure of Water		4.07			
ZT		199.00	Duct Width (in.)	0.00	
PM		194.15	Duct Length (in.)	0.00	
Barometric Pressure		29.36	Duct Area (ft ²)	0.00	
Moisture Content		6.62	Stack Diameter (in.)	108.00	
O ₂ %		9.105	Stack Area (ft ²)	63.62	
CO ₂ %		11.242			
Standard CFH		5,043,980	Molecular Weight (dry)	30.163	
K Standard CFH		84.066	Molecular Weight (wet)	29.357	
Moisture		6.62	Stack Pressure	29.31	
Fuel Factor		1833	Feet per Second	33.425	
DSCFM		78498	Actual CFM	127586.18	
DSCFM			DSCFM	78497.69	

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O ₂ (dry)	9.11	0.03	11.01	11.0	9.11
CO ₂ (wet)	10.44	0.01	8.48	8.5	10.50
NOx (wet)	40.45	0.07	113.10	113.2	40.44
SO ₂ (wet)	85.90	0.46	113.64	114.4	86.37
Moisture	6.62	<u>Standard CFH</u>			
Fuel Factor	1833	K Standard CFM			
DSCFM	78498	5,043,980			84.066

Results

	Start Stop	12:10 AM 12:20 AM	Gases Start Gases Stop	12:10 AM 12:30 AM
CO ₂ %, wet		10.5		
NOX ppm, wet		40.4		
NOx LB/mmBTU		0.084		
SO ₂ ppm, wet		86.4		
SO ₂ LB/mmBTU		0.250		
SCFH		5,044,000		
WAF applied		0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 4

<u>Time</u>	<u>SO₂ ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
12:45:07	89.752	39.739	9.349	10.187
12:46:07	92.529	38.198	9.368	10.149
12:47:07	90.429	38.381	9.267	10.269
12:48:07	90.627	38.595	9.24	10.277
12:49:07	89.961	37.842	9.34	10.234
12:50:07	89.61	38.284	9.197	10.343
12:51:07	89.574	38.813	9.225	10.33
12:52:07	90.525	38.544	9.303	10.278
12:53:07	94.131	38.061	9.305	10.275
12:54:07	94.274	38.818	9.322	10.225
12:55:07	92.794	38.839	9.285	10.275
12:56:07	91.482	38.834	9.313	10.241
12:57:07	92.463	38.356	9.322	10.237
12:58:07	94.045	37.877	9.317	10.239
12:59:07	84.824	38.92	9.294	10.293
13:00:07	94.828	38.625	9.408	10.167
13:01:07	98.063	38.396	9.44	10.103
13:02:07	98.495	38.091	9.418	10.142
13:03:07	99.92	38.106	9.399	10.146
13:04:07	98.343	38.015	9.347	10.171
13:05:07	97.3	38.218	9.296	10.268
Average	93.046	38.455	9.322	10.231

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 4
172 Kilbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.380	0.616	320	
2	A-2	0.350	0.592	320	
3	A-3	0.340	0.583	320	
4	A-4	0.200	0.447	320	
5	A-5	0.200	0.447	320	
6	A-6	0.240	0.490	320	
7	A-7	0.240	0.490	320	
8	A-8	0.240	0.490	320	
9	B-1	0.280	0.529	323	
10	B-2	0.210	0.458	323	
11	B-3	0.220	0.469	323	
12	B-4	0.200	0.447	323	
13	B-5	0.190	0.436	323	
14	B-6	0.220	0.469	323	
15	B-7	0.250	0.500	323	
16	B-8	0.250	0.500	323	12:55 AM
Average		0.251	0.498	322	
<u>Moisture Content Data</u>					
Dry Bulb (°F)		322	<u>Flow Rate Data</u>		
Wet Bulb (°F)		126.0	Static Pressure	-0.68	
TRA		1.15	Pilot Coefficient	0.815	
Vapor Pressure of Water		4.07			
ZT		195.50	Duct Width (in.)	0	
PM		197.89	Duct Length (in.)	0	
Barometric Pressure		29.36	Duct Area (ft ²)	0	
Moisture Content		6.75	Stack Diameter (in.)	108	
O ₂ %		9.313	Stack Area (ft ²)	63.6172512	
CO ₂ %		11.039			
Standard CFH		4,987,893	Molecular Weight (dry)	30.139	
K Standard CFH		83.132	Molecular Weight (wet)	29.319	
<u>Field Calculations</u>					
<u>Raw Data Table</u>					
<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.32	0.03	11.01	11.0	9.31
CO ₂ (wet)	10.23	0.01	8.47	8.5	10.29
NOx (wet)	38.45	0.11	113.46	113.2	38.30
SO ₂ (wet)	93.05	0.44	114.09	114.4	93.22
Moisture	6.75	<u>Standard CFH</u>			4,987,893
Fuel Factor	1833	<u>K Standard CFM</u>			83.132
DSCFM	77519				
<u>Results</u>					
Start		12:45 AM	Gases Start	12:45 AM	
Stop		12:55 AM	Gases Stop	1:05 AM	
CO ₂ %, wet		10.3			
NOX ppm, wet		38.3			
NOx LB/mmBTU		0.081			
SO ₂ ppm, wet		93.2			
SO ₂ LB/mmBTU		0.276			
SCFH		4,988,000			
WAF applied		0.9950			

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 5

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
1:20:37	80.79	39.948	9.319	10.219
1:21:37	82.163	39.917	9.34	10.23
1:22:37	84.381	40.278	9.401	10.122
1:23:37	85.673	39.825	9.384	10.172
1:24:37	86.507	39.124	9.385	10.177
1:25:37	88.231	39.373	9.416	10.125
1:26:37	89.981	38.656	9.37	10.218
1:27:37	92.819	38.874	9.408	10.17
1:28:37	95.139	38.467	9.333	10.235
1:29:37	90.632	39.022	9.331	10.236
1:30:37	89.874	38.818	9.214	10.337
1:31:37	86.334	39.815	9.349	10.22
1:32:37	85.927	39.881	9.294	10.26
1:33:37	86.085	38.991	9.284	10.284
1:34:37	88.435	38.798	9.296	10.253
1:35:37	92.036	38.605	9.256	10.262
1:36:37	90.012	38.564	9.263	10.234
1:37:37	85.286	38.864	9.265	10.275
1:38:37	84.518	38.559	9.214	10.347
1:39:37	96.741	37.949	9.239	10.287
1:40:37	96.263	39.246	9.16	10.332
Average	88.468	39.123	9.311	10.238

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 5
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.250	0.500	324	
2	A-2	0.300	0.548	324	
3	A-3	0.230	0.480	324	
4	A-4	0.250	0.500	324	
5	A-5	0.230	0.480	324	
6	A-6	0.260	0.510	324	
7	A-7	0.270	0.520	324	
8	A-8	0.250	0.500	324	
9	B-1	0.300	0.548	327	
10	B-2	0.240	0.490	327	
11	B-3	0.230	0.480	327	
12	B-4	0.280	0.529	327	
13	B-5	0.220	0.469	327	
14	B-6	0.200	0.447	327	
15	B-7	0.220	0.469	327	
16	B-8	0.250	0.500	327	1:30 AM
Average		0.249	0.498	326	

<u>Moisture Content Data</u>	<u>Flow Rate Data</u>
Dry Bulb (°F)	326
Wet Bulb (°F)	126.0
TRA	1.15
Vapor Pressure of Water	4.07
ZT	199.50
PM	193.62
Barometric Pressure	29.36
Moisture Content	6.61
O ₂ %	9.302
CO ₂ %	11.049
Standard CFH	4,976,149
K Standard CFH	82.936
<u>Flow Rate Data</u>	
Static Pressure	-0.69
Pilot Coefficient	0.815
Duct Width (in.)	0
Duct Length (in.)	0
Duct Area (ft ²)	0
Stack Diameter (in.)	108
Stack Area (ft ²)	63.6172512
Molecular Weight (dry)	30.14
Molecular Weight (wet)	29.338
Stack Pressure	29.309
Feet per Second	32.998
Actual CFM	125953.74
DSCFM	77456.87

Field Calculations

<u>Raw Data Table</u>					
<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.31	0.03	11.01	11.0	9.30
CO ₂ (wet)	10.24	0.01	8.46	8.5	10.32
NOx (wet)	39.12	0.12	113.83	113.2	38.83
SO ₂ (wet)	88.47	0.48	113.75	114.4	88.87
Moisture	6.61			Standard CFH	4,976,149
Fuel Factor	1833			K Standard CFM	82.936
DSCFM	77457				

Results

Start Stop	1:20 AM 1:30 AM	Gases Start Gases Stop	1:20 AM 1:40 AM
CO ₂ %, wet	10.3		
NOX ppm, wet	38.8		
NOx LB/mmBTU	0.082		
SO ₂ ppm, wet	88.9		
SO ₂ LB/mmBTU	0.262		
SCFH	4,976,000		
WAF applied	0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 6

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
1:55:17	85.403	38.467	9.136	10.33
1:56:17	75.974	39.419	9.16	10.348
1:57:17	80.022	38.579	9.007	10.445
1:58:17	81.965	38.183	9.082	10.409
1:59:17	81.355	39.363	9.162	10.339
2:00:17	80.617	40.07	9.201	10.288
2:01:17	83.262	39.734	9.263	10.243
2:02:17	84.269	39.546	9.249	10.197
2:03:17	84.086	39.469	9.182	10.293
2:04:17	83.12	39.551	9.256	10.228
2:05:17	80.663	40.639	9.242	10.235
2:06:17	74.834	41.148	9.218	10.24
2:07:17	72.255	41.946	9.211	10.231
2:08:17	68.914	43.783	9.303	10.164
2:09:17	68.812	44.083	9.281	10.175
2:10:17	68.176	43.849	9.275	10.171
2:11:17	67.139	44.378	9.384	10.096
2:12:17	67.968	45.497	9.46	10.014
2:13:17	68.247	45.141	9.541	9.91
2:14:17	69.453	44.52	9.575	9.861
2:15:17	74.722	44.245	9.593	9.846
Average	76.250	41.505	9.275	10.193

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 6
172 KIbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.230	0.480	324	
2	A-2	0.250	0.500	324	
3	A-3	0.230	0.480	324	
4	A-4	0.240	0.490	324	
5	A-5	0.220	0.469	324	
6	A-6	0.230	0.480	324	
7	A-7	0.280	0.529	324	
8	A-8	0.220	0.469	324	
9	B-1	0.280	0.529	325	
10	B-2	0.280	0.529	325	
11	B-3	0.250	0.500	325	
12	B-4	0.200	0.447	325	
13	B-5	0.200	0.447	325	
14	B-6	0.230	0.480	325	
15	B-7	0.240	0.490	325	
16	B-8	0.280	0.529	325	2:05 AM
Average		0.241	0.490	325	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	325	
Wet Bulb (°F)	127.0	Static Pressure
TRA	1.14	Pilot Coefficient
Vapor Pressure of Water	4.18	
ZT	197.50	Duct Width (in.)
PM	206.90	Duct Length (in.)
Barometric Pressure	29.36	Duct Area (ft ²)
		Stack Diameter (in.)
		Stack Area (ft ²)
Moisture Content	7.06	Molecular Weight (dry)
O ₂ %	9.271	Molecular Weight (wet)
CO ₂ %	11.045	Stack Pressure
		Feet per Second
Standard CFH	4,908,736	Actual CFM
K Standard CFH	81.812	DSCFM

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.28	0.03	11.00	11.0	9.27
CO ₂ (wet)	10.19	0.00	8.46	8.5	10.27
NOx (wet)	41.51	0.24	113.90	113.2	41.10
SO ₂ (wet)	76.25	0.51	113.30	114.4	76.82
Moisture Fuel Factor	7.06			Standard CFH	4,908,736
DSCFM	1833			K Standard CFM	81.812
	76037				

Results

Start Stop	1:55 AM 2:05 AM	Gases Start Gases Stop	1:55 AM 2:15 AM
CO ₂ %, wet	10.3		
NOX ppm, wet	41.1		
NOx LB/mmBTU	0.088		
SO ₂ ppm, wet	76.8		
SO ₂ LB/mmBTU	0.228		
SCFH	4,909,000		
WAF applied	0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 7

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
2:30:57	78.801	43.971	9.505	9.986
2:31:57	80.973	43.864	9.614	9.908
2:32:57	81.853	43.62	9.614	9.862
2:33:57	85.093	42.124	9.515	9.952
2:34:57	86.756	41.555	9.366	10.108
2:35:57	85.541	41.189	9.411	10.038
2:36:57	80.617	42.241	9.491	10.003
2:37:57	81.37	42.597	9.464	10.036
2:38:57	80.627	43.126	9.532	9.972
2:39:57	86.212	42.14	9.509	9.961
2:40:57	88.547	41.921	9.449	10.015
2:41:57	89.03	41.173	9.396	10.077
2:42:57	88.974	41.407	9.454	10.043
2:43:57	90.185	42.333	9.518	9.985
2:44:57	92.412	41.524	9.444	10.013
2:45:57	92.916	41.189	9.458	10.038
2:46:57	92.748	41.448	9.438	10.052
2:47:57	91.883	41.387	9.394	10.072
2:48:57	89.193	41.3	9.354	10.151
2:49:57	90.027	40.904	9.275	10.209
2:50:57	88.75	41.428	9.34	10.155
Average	86.786	42.021	9.454	10.030

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 7
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.200	0.447	325	
2	A-2	0.230	0.480	325	
3	A-3	0.240	0.490	325	
4	A-4	0.210	0.458	325	
5	A-5	0.210	0.458	325	
6	A-6	0.260	0.510	325	
7	A-7	0.250	0.500	325	
8	A-8	0.270	0.520	325	
9	B-1	0.200	0.447	323	
10	B-2	0.190	0.436	323	
11	B-3	0.260	0.510	323	
12	B-4	0.220	0.469	323	
13	B-5	0.210	0.458	323	
14	B-6	0.250	0.500	323	
15	B-7	0.280	0.529	323	
16	B-8	0.290	0.539	323	2:40 AM
Average		0.236	0.484	324	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	324	
Wet Bulb (°F)	128.0	Static Pressure
TRA	1.14	Pitot Coefficient
Vapor Pressure of Water	4.29	
ZT	196.00	Duct Width (in.)
PM	219.93	Duct Length (in.)
Barometric Pressure	29.36	Duct Area (ft ²)
Moisture Content	7.50	Stack Diameter (in.)
O ₂ %	9.452	Stack Area (ft ²)
CO ₂ %	10.919	
Standard CFH	4,855,367	Molecular Weight (dry)
K Standard CFH	80.923	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		DSCFM
		122652.66
		74851.06

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.45	0.02	11.00	11.0	9.45
CO ₂ (wet)	10.03	-0.01	8.46	8.5	10.10
NOx (wet)	42.02	0.35	113.73	113.2	41.61
SO ₂ (wet)	86.79	0.46	113.55	114.4	87.33
Moisture	7.50				
Fuel Factor	1833				
DSCFM	74851				
				4,855,367	
				80.923	

Results

Start Stop	2:30 AM 2:40 AM	Gases Start Gases Stop	2:30 AM 2:50 AM
CO ₂ %, wet	10.1		
NOX ppm, wet	41.6		
NOx LB/mmBTU	0.090		
SO ₂ ppm, wet	87.3		
SO ₂ LB/mmBTU	0.263		
SCFH	4,855,000		
WAF applied	0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 8

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
3:10:17	79.936	41.178	9.281	10.152
3:11:17	89.193	39.831	9.19	10.23
3:12:17	91.125	39.734	9.272	10.168
3:13:17	95.851	38.467	9.093	10.322
3:14:17	92.697	37.771	9.276	10.186
3:15:17	88.058	39.179	9.392	10.084
3:16:17	87.341	39.591	9.48	10.02
3:17:17	91.187	39.22	9.463	10.006
3:18:17	92.662	39.902	9.277	10.164
3:19:17	93.063	40.914	9.188	10.252
3:20:17	92.102	41.25	9.172	10.279
3:21:17	90.307	40.777	9.211	10.241
3:22:17	86.533	42.079	9.406	10.047
3:23:17	91.593	41.855	9.459	10.003
3:24:17	93.643	41.183	9.373	10.059
3:25:17	92.433	40.761	9.288	10.133
3:26:17	89.518	41.56	9.317	10.137
3:27:17	88.938	42.313	9.379	10.085
3:28:17	87.016	42.414	9.357	10.105
3:29:17	87.743	42.445	9.438	10.035
3:30:17	90.83	43.523	9.541	9.95
Average	90.084	40.759	9.326	10.127

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 8
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points

16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.290	0.539	326	
2	A-2	0.320	0.566	326	
3	A-3	0.280	0.529	326	
4	A-4	0.320	0.566	326	
5	A-5	0.210	0.458	326	
6	A-6	0.220	0.469	326	
7	A-7	0.220	0.469	326	
8	A-8	0.260	0.510	326	
9	B-1	0.210	0.458	323	
10	B-2	0.210	0.458	323	
11	B-3	0.200	0.447	323	
12	B-4	0.230	0.480	323	
13	B-5	0.230	0.480	323	
14	B-6	0.190	0.436	323	
15	B-7	0.260	0.510	323	
16	B-8	0.290	0.539	323	3:20 AM
Average		0.246	0.495	325	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	325	
Wet Bulb (°F)	125.0	Static Pressure
TRA	1.15	Pitot Coefficient
Vapor Pressure of Water	3.96	
ZT	199.50	Duct Width (in.)
PM	182.72	Duct Length (in.)
Barometric Pressure	29.36	Duct Area (ft ²)
Moisture Content	6.23	Stack Diameter (in.)
O ₂ %	9.31	Stack Area (ft ²)
CO ₂ %	10.854	
Standard CFH	4,943,219	Molecular Weight (dry)
K Standard CFH	82.387	Molecular Weight (wet)
		Stack Pressure
		Feet per Second
		Actual CFM
		DSCFM
		124960.95
		77250.82

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.33	0.03	11.02	11.0	9.31
CO ₂ (wet)	10.13	-0.02	8.48	8.5	10.18
NOx (wet)	40.76	0.36	113.87	113.2	40.29
SO ₂ (wet)	90.08	0.31	114.01	114.4	90.33
Moisture	6.23				
Fuel Factor	1833				
DSCFM	77251				
				4,943,219	
				82.387	

Results

	<u>Start Stop</u>	<u>3:10 AM</u>	<u>Gases Start Stop</u>	<u>3:10 AM</u>
CO ₂ %, wet		10.2		
NOX ppm, wet		40.3		
NOx LB/mmBTU		0.087		
SO ₂ ppm, wet		90.3		
SO ₂ LB/mmBTU		0.270		
SCFH		4,943,000		
WAF applied		0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 9

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
3:45:17	87.062	42.689	9.497	10.003
3:46:17	88.369	42.623	9.562	9.944
3:47:17	92.539	42.068	9.524	9.987
3:48:17	97.687	40.919	9.506	9.969
3:49:17	98.175	40.187	9.532	9.974
3:50:17	95.647	40.787	9.721	10.086
3:51:17	95.083	39.993	9.467	10.115
3:52:17	92.804	40.538	9.458	10.074
3:53:17	87.708	40.904	9.407	10.082
3:54:17	89.127	41.285	9.387	10.102
3:55:17	84.381	42.918	9.394	10.107
3:56:17	80.16	43.35	9.338	10.14
3:57:17	82.245	43.874	9.434	10.073
3:58:17	85.18	43.584	9.534	10.044
3:59:17	83.023	43.854	10.242	9.954
4:00:17	81.019	43.808	9.846	9.932
4:01:17	79.941	43.991	9.58	9.932
4:02:17	78.522	46.397	9.571	9.936
4:03:17	81.884	44.159	9.628	9.881
4:04:17	83.227	42.938	9.672	9.819
4:05:17	86.655	43.035	9.607	9.865
Average	87.164	42.567	9.567	10.001

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 9
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points 16

<u>Point Number</u>		<u>Delta p</u>	<u>Sq. root delta p</u>	<u>Temperature</u>	<u>Time</u>
1	A-1	0.240	0.490	329	
2	A-2	0.210	0.458	329	
3	A-3	0.230	0.480	329	
4	A-4	0.210	0.458	329	
5	A-5	0.200	0.447	329	
6	A-6	0.250	0.500	329	
7	A-7	0.270	0.520	329	
8	A-8	0.200	0.447	329	
9	B-1	0.250	0.500	330	
10	B-2	0.330	0.574	330	
11	B-3	0.270	0.520	330	
12	B-4	0.200	0.447	330	
13	B-5	0.190	0.436	330	
14	B-6	0.220	0.469	330	
15	B-7	0.240	0.490	330	
16	B-8	0.220	0.469	330	3:55 AM
Average		0.233	0.482	330	

Moisture Content Data

		<u>Flow Rate Data</u>
Dry Bulb (°F)	330	
Wet Bulb (°F)	128.0	
TRA	1.14	Static Pressure
Vapor Pressure of Water	4.29	Pilot Coefficient
ZT	201.50	0.68
PM	214.07	0.815
Barometric Pressure	29.36	
Moisture Content	7.30	
O ₂ %	9.546	Duct Width (in.)
CO ₂ %	10.823	Duct Length (in.)
Standard CFH	4,808,788	Duct Area (ft ²)
K Standard CFH	80.146	Stack Diameter (in.)
		108.00
		Stack Area (ft ²)
		63.62
Moisture Content	7.30	Molecular Weight (dry)
O ₂ %	9.546	30.114
CO ₂ %	10.823	Molecular Weight (wet)
Standard CFH	4,808,788	29.229
K Standard CFH	80.146	Stack Pressure
		29.31
		Feet per Second
		32.05
		Actual CFM
		122334.34
		DSCFM
		74292.9

Field Calculations

Raw Data Table

<u>Instrument</u>	<u>ppm or %</u>	<u>Zero</u>	<u>Span</u>	<u>Cylinder Value</u>	<u>Gas Corrected for Calibration</u>
O ₂ (dry)	9.57	0.03	11.02	11.0	9.55
CO ₂ (wet)	10.00	-0.02	8.49	8.5	10.03
NOx (wet)	42.57	0.36	114.05	113.2	42.03
SO ₂ (wet)	87.16	0.32	114.27	114.4	87.19
Moisture	7.30				
Fuel Factor	1833				
DSCFM	74293				
Standard CFH				4,808,788	
K Standard CFM				80.146	

Results

Start Stop	3:45 AM 3:55 AM	Gases Start Gases Stop	3:45 AM 4:05 AM
CO ₂ %, wet	10.0		
NOX ppm, wet	42.0		
NOx LB/mmBTU	0.092		
SO ₂ ppm, wet	87.2		
SO ₂ LB/mmBTU	0.265		
SCFH	4,809,000		
WAF applied	0.9950		

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19/2011
Run 10

Time	SO₂ ppm, w	Nox ppm, w	%O₂, d	% CO₂, w
4:20:07	84.167	43.569	9.504	9.945
4:21:07	77.535	44.423	9.553	9.902
4:22:07	82.077	45.125	9.572	9.933
4:23:07	92.957	42.928	9.603	9.875
4:24:07	102.783	42.236	9.757	9.734
4:25:07	109.558	41.748	9.632	9.862
4:26:07	108.922	41.011	9.558	9.894
4:27:07	107.457	41.026	9.515	9.967
4:28:07	98.826	42.267	9.473	10.012
4:29:07	97.544	41.901	9.525	9.99
4:30:07	97.621	41.875	9.654	9.872
4:31:07	102.971	40.609	9.66	9.847
4:32:07	106.288	41.061	9.761	9.776
4:33:07	111.944	40.563	9.716	9.774
4:34:07	113.393	40.151	9.697	9.809
4:35:07	112.457	39.963	9.672	9.833
4:36:07	108.902	40.507	9.655	9.858
4:37:07	105.525	40.914	9.537	9.975
4:38:07	103.658	39.698	9.467	10.027
4:39:07	102.87	39.815	9.449	10.055
4:40:07	100.143	40.222	9.527	10.019
Average	101.314	41.505	9.595	9.903

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler

9/19-20/2011
Test 1N Run 10
172 Klbs/Hr

Volumetric Flow Rate Data

Number of Sample Points

16

Point Number		Delta p	Sq. root delta p	Temperature	Time
1	A-1	0.250	0.500	325	
2	A-2	0.300	0.548	325	
3	A-3	0.260	0.510	325	
4	A-4	0.250	0.500	325	
5	A-5	0.210	0.458	325	
6	A-6	0.210	0.458	325	
7	A-7	0.230	0.480	325	
8	A-8	0.230	0.480	325	
9	B-1	0.200	0.447	330	
10	B-2	0.260	0.510	330	
11	B-3	0.250	0.500	330	
12	B-4	0.190	0.436	330	
13	B-5	0.200	0.447	330	
14	B-6	0.230	0.480	330	
15	B-7	0.230	0.480	330	
16	B-8	0.270	0.520	330	4:30 AM
Average		0.236	0.485	328	

Moisture Content Data

	Flow Rate Data
Dry Bulb (°F)	328
Wet Bulb (°F)	126.0
TRA	1.15
Vapor Pressure of Water	4.07
ZT	201.50
PM	191.48
Barometric Pressure	29.36
Moisture Content	6.53
O ₂ %	9.565
CO ₂ %	10.655
Standard CFH	4,838,634
K Standard CFH	80,644
Molecular Weight (dry)	
Molecular Weight (wet)	
Stack Pressure	
Feet per Second	
Actual CFM	
DSCFM	
108.00	
63.62	
30.087	
29.298	
29.31	
32.167	
122781.77	
75375.36	

Field Calculations

Raw Data Table

Instrument	ppm or %	Zero	Span	Cylinder Value	Gas Corrected for Calibration
O ₂ (dry)	9.59	0.03	11.03	11.0	9.56
CO ₂ (wet)	9.90	-0.02	8.47	8.5	9.96
NOx (wet)	41.51	0.43	113.74	113.2	41.04
SO ₂ (wet)	101.31	0.45	113.95	114.4	101.66
Moisture	6.53				
Fuel Factor	1833				
DSCFM	75375				
				Standard CFH	4,838,634
				K Standard CFM	80,644

Results

Start Stop	4:20 AM 4:30 AM	Gases Start Gases Stop	4:20 AM 4:40 AM
CO ₂ %, wet	10.0		
NOX ppm, wet	41.0		
NOx LB/mmBTU	0.090		
SO ₂ ppm, wet	101.7		
SO ₂ LB/mmBTU	0.311		
SCFH	4,839,000		
WAF applied	0.9950		

APPENDIX D

MEASUREMENT SYSTEMS PERFORMANCE SPECIFICATIONS

Calibration Error

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19-20/2011
Test 1N

S0₂(TEI Model 43i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.33	0.33	114.40	0.29
Low Level	50.20	50.42	0.22	114.40	0.19
Mid Level	114.40	114.61	0.21	114.40	0.18
High Level	249.00	252.66	3.66	249.00	1.47

NOx (TEI Model 42i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.08	0.08	113.20	0.07
Mid Level	49.50	49.16	0.34	113.20	0.30
High Level	113.20	113.05	0.15	113.20	0.13

CO₂ (TEI Model 41i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.01	0.01	17.36	0.06
Mid Level	8.52	8.53	0.01	17.36	0.06
High Level	17.36	17.64	0.28	17.36	1.61

O₂ (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (%)	% of Span
Zero	0.00	0.05	0.05	20.99	0.24
Mid Level	11.00	11.03	0.03	20.99	0.14
High Level	20.99	21.03	0.04	20.99	0.19

**** All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU
 Manitowoc, WI
 No. 9 Boiler
 9/19-20/2011
 Test 1N

O₂						
		Initial	Pre-Cal Bias	Final	Post-cal Bias	% Drift of Span
1	Zero	0.05	0.00%	0.02	-0.14%	0.04
	Upscale	11.03	0.00%	11.01	-0.10%	11.02
2	Zero	0.02	-0.14%	0.02	-0.14%	0.02
	Upscale	11.01	-0.10%	11.00	-0.14%	11.01
3	Zero	0.02	-0.14%	0.03	-0.10%	0.03
	Upscale	11.00	-0.14%	11.01	-0.10%	11.01
4	Zero	0.03	-0.10%	0.03	-0.10%	0.03
	Upscale	11.01	-0.10%	11.00	-0.14%	11.01
5	Zero	0.03	-0.10%	0.03	-0.10%	0.03
	Upscale	11.00	-0.14%	11.01	-0.10%	11.01
6	Zero	0.03	-0.10%	0.02	-0.14%	0.03
	Upscale	11.01	-0.10%	10.99	-0.19%	11.00
7	Zero	0.02	-0.14%	0.02	-0.14%	0.02
	Upscale	10.99	-0.19%	11.01	-0.10%	11.00
8	Zero	0.02	-0.14%	0.03	-0.10%	0.03
	Upscale	11.01	-0.10%	11.02	-0.05%	11.02
9	Zero	0.03	-0.10%	0.03	-0.10%	0.03
	Upscale	11.02	-0.05%	11.02	-0.05%	11.02
10	Zero	0.03	-0.10%	0.03	-0.10%	0.03
	Upscale	11.02	-0.05%	11.04	0.05%	11.03

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.05 %
Upscale	11.00 %	11.03 %
Span	20.99 %	20.99 %

** All Drift Calibrations must be within 3% of the span value...

** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
 Manitowoc, WI
 No. 9 Boiler
 9/19-20/2011
 Test 1N

CO₂

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.53	0.00%	8.50	-0.17%	8.52	-0.17%
2	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.50	-0.17%	8.46	-0.40%	8.48	-0.23%
3	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.46	-0.40%	8.49	-0.23%	8.48	0.17%
4	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.49	-0.23%	8.45	-0.46%	8.47	-0.23%
5	Zero	0.01	0.00%	0.01	0.00%	0.01	0.00%
	Upscale	8.45	-0.46%	8.46	-0.40%	8.46	0.06%
6	Zero	0.01	0.00%	-0.01	-0.12%	0.00	-0.12%
	Upscale	8.46	-0.40%	8.46	-0.40%	8.46	0.00%
7	Zero	-0.01	-0.12%	-0.01	-0.12%	-0.01	0.00%
	Upscale	8.46	-0.40%	8.46	-0.40%	8.46	0.00%
8	Zero	-0.01	-0.12%	-0.02	-0.17%	-0.02	-0.06%
	Upscale	8.46	-0.40%	8.49	-0.23%	8.48	0.17%
9	Zero	-0.02	-0.17%	-0.02	-0.17%	-0.02	0.00%
	Upscale	8.49	-0.23%	8.49	-0.23%	8.49	0.00%
10	Zero	-0.02	-0.17%	-0.01	-0.12%	-0.02	0.06%
	Upscale	8.49	-0.23%	8.45	-0.46%	8.47	-0.23%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.01 ppm
Upscale	8.52 ppm	8.53 ppm
Span	17.36 ppm	17.36 ppm

** All Drift Calibrations must be within 3% of the span value...

** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/19-20/2011
Test 1N

Nox

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.08	0.00%	0.04	-0.04%	0.06	-0.04%
	Upscale	113.05	0.00%	113.02	-0.03%	113.04	-0.03%
2	Zero	0.04	-0.04%	0.03	-0.04%	0.04	-0.01%
	Upscale	113.02	-0.03%	112.76	-0.26%	112.89	-0.23%
3	Zero	0.03	-0.04%	0.11	0.03%	0.07	0.07%
	Upscale	112.76	-0.26%	113.44	0.34%	113.10	0.60%
4	Zero	0.11	0.03%	0.10	0.02%	0.11	-0.01%
	Upscale	113.44	0.34%	113.47	0.37%	113.46	0.03%
5	Zero	0.10	0.02%	0.14	0.05%	0.12	0.04%
	Upscale	113.47	0.37%	114.18	1.00%	113.83	0.63%
6	Zero	0.14	0.05%	0.33	0.22%	0.24	0.17%
	Upscale	114.18	1.00%	113.62	0.50%	113.90	-0.49%
7	Zero	0.33	0.22%	0.37	0.26%	0.35	0.04%
	Upscale	113.62	0.50%	113.83	0.69%	113.73	0.19%
8	Zero	0.37	0.26%	0.35	0.24%	0.36	-0.02%
	Upscale	113.83	0.69%	113.90	0.75%	113.87	0.06%
9	Zero	0.35	0.24%	0.36	0.25%	0.36	0.01%
	Upscale	113.90	0.75%	114.19	1.01%	114.05	0.26%
10	Zero	0.36	0.25%	0.49	0.36%	0.43	0.11%
	Upscale	114.19	1.01%	113.28	0.20%	113.74	-0.80%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.08 ppm
Upscale	113.20 ppm	113.05 ppm
Span	113.20 ppm	113.20 ppm

** All Drift Calibrations must be within 3% of the span value...

** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
 Manitowoc, WI
 No. 9 Boiler
 9/19-20/2011
 Test 1N

SO₂

		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.33	0.00%	0.18	-0.13%	0.26	-0.13%
	Upscale	114.61	0.00%	114.28	-0.29%	114.45	-0.29%
2	Zero	0.18	-0.13%	0.47	0.12%	0.33	0.25%
	Upscale	114.28	-0.29%	113.33	-1.12%	113.81	-0.83%
3	Zero	0.47	0.12%	0.44	0.10%	0.46	-0.03%
	Upscale	113.33	-1.12%	113.94	-0.59%	113.64	0.53%
4	Zero	0.44	0.10%	0.44	0.10%	0.44	0.00%
	Upscale	113.94	-0.59%	114.24	-0.32%	114.09	0.26%
5	Zero	0.44	0.10%	0.52	0.17%	0.48	0.07%
	Upscale	114.24	-0.32%	113.25	-1.19%	113.75	-0.87%
6	Zero	0.52	0.17%	0.50	0.15%	0.51	-0.02%
	Upscale	113.25	-1.19%	113.34	-1.11%	113.30	0.08%
7	Zero	0.50	0.15%	0.42	0.08%	0.46	-0.07%
	Upscale	113.34	-1.11%	113.76	-0.74%	113.55	0.37%
8	Zero	0.42	0.08%	0.19	-0.12%	0.31	-0.20%
	Upscale	113.76	-0.74%	114.25	-0.31%	114.01	0.43%
9	Zero	0.19	-0.12%	0.45	0.10%	0.32	0.23%
	Upscale	114.25	-0.31%	114.28	-0.29%	114.27	0.03%
10	Zero	0.45	0.10%	0.44	0.10%	0.45	-0.01%
	Upscale	114.28	-0.29%	113.62	-0.87%	113.95	-0.58%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.33 ppm
Upscale	114.40 ppm	114.61 ppm
Span	114.40 ppm	114.40 ppm

** All Drift Calibrations must be within 3% of the span value...

** All Bias Calibrations must be within 5% of the span value...

Interpoll Laboratories
(763) 786-6020

Stationary Gas Turbine Nox Determination
Method 20 NO₂ to NO Converter Efficiency Datasheet

Job Source	MSI / Manitowoc PU
Date	No. 9 Boiler
Operator	9/19-20/2011
Analyzer	RE / JH / AS
Analyzer S/N	TECO Model 42i-LS (NOx)
	615216893

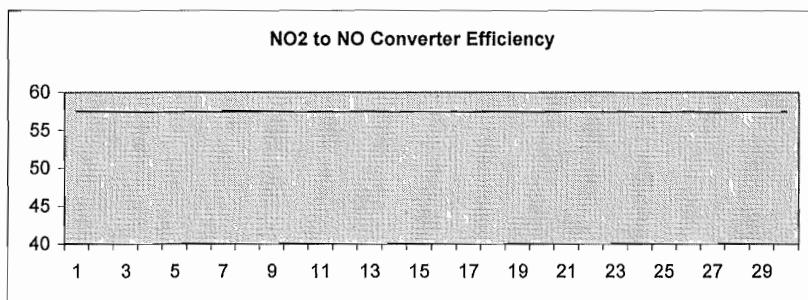
Time (min)	NOx Response
9:00 PM	57.492
9:01 PM	57.482
9:02 PM	57.395
9:03 PM	57.373
9:04 PM	57.408
9:05 PM	57.446
9:06 PM	57.460
9:07 PM	57.459
9:08 PM	57.474
9:09 PM	57.400
9:10 PM	57.457
9:11 PM	57.395
9:12 PM	57.491
9:13 PM	57.419
9:14 PM	57.484
9:15 PM	57.462
9:16 PM	57.399
9:17 PM	57.497
9:18 PM	57.432
9:19 PM	57.412
9:20 PM	57.471
9:21 PM	57.435
9:22 PM	57.397
9:23 PM	57.494
9:24 PM	57.384
9:25 PM	57.466
9:26 PM	57.384
9:27 PM	57.360
9:28 PM	57.368
9:29 PM	57.435

Highest Peak Value 57.50

Percent Drift 0.1%

System Pass or Fail PASS

Instructions: Add mid-level gas to a leak-free Tedlar bag. Dilute the gas with 20.9% Oxygen to approximately 1:1. Then immediately attach the bag to the instrument and record the NOx Responses for 30 minutes. The system is OK if the response at the end is less than 2.0 % of the highest response.



INTERPOLL LABORATORIES, INC.
 (763) 786-6020
EPA Appendix A Stratification Test

Job:	MSI / Manitowoc PU	Date:	9/19-20/2011
Source:	No. 9 Boiler	Personnel:	RE / JH / AS
Test	1N	Bar. Press. (in. Hg)	29.36
PDT Number	85 / 109		
Measurement Response Time:	98	seconds	

Stack Diameter	108.00	in.	Port Length	in.	11.50				
Traverse Point	Fraction of Diameter	Distance From Stack Wall (in.)	Distance From End of Port (in.)		Time (min)	SO2 ppm (wet)	Nox ppm (wet)	O2 % (dry)	CO2 % (wet)
1	0.17	18.00	29.50		11:00	98.07	34.80	9.00	10.64
2	0.50	54.00	65.50		11:07	96.10	33.93	9.19	10.55
3	0.83	90.00	101.50		11:14	90.98	36.25	9.03	10.74
Average						95.05	34.99	9.07	10.64
						Largest Value	98.07	36.25	9.19
						Smallest Value	90.98	33.93	9.00
						%Deviation	7.79%	6.83%	2.07% 1.77%

* A three point traverse was used for each test run.

MSI / Manitowoc PU
 Manitowoc, WI
 No. 9 Boiler
 9/19-20/2011
 Stratification Test Data

<u>Time</u>	<u>SO₂ ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
11:00:17	92.75	35.45	9.01	10.64
11:01:17	98.50	34.60	8.98	10.62
11:02:17	101.12	34.06	8.93	10.68
11:03:17	99.86	34.20	9.00	10.64
11:04:17	97.63	35.77	9.08	10.61
11:05:17	97.75	34.91	9.01	10.66
11:06:17	98.86	34.64	9.03	10.63
Average	98.07	34.80	9.00	10.64

<u>Time</u>	<u>SO₂ ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
11:07:17	95.23	34.63	9.19	10.51
11:08:17	93.67	34.15	9.32	10.42
11:09:17	96.25	33.53	9.35	10.42
11:10:17	100.17	33.44	9.17	10.58
11:11:17	96.54	33.98	9.09	10.67
11:12:17	94.45	34.73	9.23	10.53
11:13:17	96.39	33.05	8.98	10.75
Average	96.10	33.93	9.19	10.55

<u>Time</u>	<u>SO₂ ppm, w</u>	<u>Nox ppm, w</u>	<u>%O₂, d</u>	<u>% CO₂, w</u>
11:14:17	94.16	34.47	8.90	10.84
11:15:17	93.00	34.84	8.93	10.84
11:16:17	94.74	35.12	9.00	10.76
11:17:17	90.65	36.37	9.03	10.74
11:18:17	88.67	36.62	9.01	10.74
11:19:17	89.10	37.28	9.10	10.70
11:20:17	86.56	39.05	9.21	10.57
Average	90.98	36.25	9.03	10.74

MSI / Manitowoc PU

Manitowoc, WI

No. 9 Boiler

9/20/2011

1M

CO₂ (TEI Model 410i)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.01	0.01	17.36	0.06
Mid Level	8.52	8.48	0.04	17.36	0.23
High Level	17.36	17.43	0.07	17.36	0.40

O₂ (Servomex Series 1400)

	Cylinder Value (ppm)	Analyzer Response (ppm)	Difference (ppm)	Span Value (ppm)	% of Span
Zero	0.00	0.02	0.02	20.99	0.10
Mid Level	11.00	11.01	0.01	20.99	0.05
High Level	20.99	21.03	0.04	20.99	0.19

**** All Calibrations must be within 2% of the span value...

Calibration Drift

MSI / Manitowoc PU
Manitowoc, WI
No. 9 Boiler
9/20/2011
1M

		O_2					
		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.02	0.00%	0.04	0.10%	0.03	0.10%
	Upscale	11.01	0.00%	11.04	0.14%	11.03	0.14%
2	Zero	0.04	0.10%	0.04	0.10%	0.04	0.00%
	Upscale	11.04	0.14%	11.04	0.14%	11.04	0.00%
3	Zero	0.04	0.10%	0.04	0.10%	0.04	0.00%
	Upscale	11.04	0.14%	11.04	0.14%	11.04	0.00%
4	Zero	0.04	0.10%	0.03	0.05%	0.04	-0.05%
	Upscale	11.04	0.14%	11.02	0.05%	11.03	-0.10%
5	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%
6	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%
7	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%
8	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%
9	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%
10	Zero	0.03	0.05%	0.03	0.05%	0.03	0.00%
	Upscale	11.02	0.05%	11.02	0.05%	11.02	0.00%

	Cylinder Value	Analyzer Value
Zero	0.00 %	0.02 %
Upscale	11.00 %	11.01 %
Span	20.99 %	20.99 %

** All Drift Calibrations must be within 3% of the span value...

** All Bias Calibrations must be within 5% of the span value...

Calibration Drift

MSI / Manitowoc PU
 Manitowoc, WI
 No. 9 Boiler
 9/20/2011
 1M

CO ₂						
		Initial	Pre-Cal Bias	Final	Post-Cal Bias	% Drift of Span
1	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.48	0.00%	8.46	-0.12%	8.47 -0.12%
2	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.46	-0.12%	8.46	-0.12%	8.46 0.00%
3	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.46	-0.12%	8.46	-0.12%	8.46 0.00%
4	Zero	0.01	0.00%	-0.01	-0.12%	0.00 -0.12%
	Upscale	8.46	-0.12%	8.51	0.17%	8.49 0.29%
5	Zero	-0.01	-0.12%	-0.01	-0.12%	-0.01 0.00%
	Upscale	8.51	0.17%	8.51	0.17%	8.51 0.00%
6	Zero	-0.01	-0.12%	-0.01	-0.12%	-0.01 0.00%
	Upscale	8.51	0.17%	8.51	0.17%	8.51 0.00%
7	Zero	-0.01	-0.12%	0.01	0.00%	0.00 0.12%
	Upscale	8.51	0.17%	8.47	-0.06%	8.49 -0.23%
8	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.47	-0.06%	8.47	-0.06%	8.47 0.00%
9	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.47	-0.06%	8.47	-0.06%	8.47 0.00%
10	Zero	0.01	0.00%	0.01	0.00%	0.01 0.00%
	Upscale	8.47	-0.06%	8.47	-0.06%	8.47 0.00%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.01 ppm
Upscale	8.52 ppm	8.48 ppm

Span	17.36 ppm	17.36 ppm

** All Drift Calibrations must be within 3% of the span value...
 ** All Bias Calibrations must be within 5% of the span value...

APPENDIX E

CALIBRATION GAS CERTIFICATION SHEETS



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Airgas
630 United Drive
Durham, NC 27713
(919) 544-3772
Fax (919) 544-6297
www.airgas.com

Part Number: E03NI62E15A0224 Reference Number: 122-124177728-2
Cylinder Number: CC148479 Cylinder Volume: 157 Cu.Ft.
Laboratory: ASG - Durham - NC Cylinder Pressure: 2015 PSIG
Analysis Date: May 15, 2009 Valve Outlet: 660

Expiration Date: May 15, 2012

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig.i.e. 1 Mega Pascal

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON DIOXIDE	17.00 %	17.36 %	G1	+/- 1% NIST Traceable
OXYGEN	21.00 %	20.99 %	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS

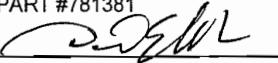
Type	Lot ID	Cylinder No.	Concentration	Expiration Date
NTRM	060608	CC206165	22.51% OXYGEN/NITROGEN	May 01, 2010
NTRM	080613	CC254471	20.09% CARBON DIOXIDE/NITROGEN	Jul 15, 2012

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 CO2	FTIR	May 11, 2009
Horiba MPA-510 O2 (0.5-25%)	Paramagnetic	May 04, 2009

Triad Data Available Upon Request

Notes: ANW PART #781381


QA Approval

THE LINDE GROUP



CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE #: G1

PGVP ID#:	I12011	GAS CODE:	OC2
CUSTOMER:	Linde Hammond Plant	CYLINDER #:	CC-88408
SALES#:	108169806	CYLINDER PRES:	2000 PSIG
PROD#:	1180579	CYLINDER VALVE:	CGA 590
P.O.# :	4501781249	CYLINDER SIZE:	2A
MATERIAL#:	24086339	CYLINDER MATERIAL:	Aluminum
CERTIFICATION DATE:	03-Jun-2011	GAS VOLUME:	4000 Liter
EXPIRATION DATE:	03-Jun-2014	BLEND TOLERANCE:	5% Relative
		PAGE:	1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Dioxide	03-Jun-2011	8.52 %	8.52 %	+/- 1%
Oxygen	03-Jun-2011	11.00 %	11.00 %	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Dioxide	GMIS-1	CC-109878	9.98 %
Oxygen	NTRM-82659X	CC-83903	22.80 %

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Dioxide	CAI-300	S03001	NDIR	18-May-2011
Oxygen	CAI 300	S03001	PM	13-May-2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST:

MATTHEW JACKSON

Linde Gas North America LLC

DATE: 03-Jun-2011

(908) 329-9700 Main (908) 329-9740 Fax
www.Lindeus.com

201617

THE LINDE GROUP



CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE #: G1

CUSTOMER: Linde Gas North America
SALES#: 107578918
PROD#: 1150533
P.O.#: 4501764807

CYLINDER # : CC-128758
CYLINDER PRES: 2000 PSIG
CGA OUTLET: 660

CERTIFICATION DATE: 9/2/2010
EXPIRATION DATE: 9/2/2012

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	8/26/2010 9/2/2010	254.1 ppm 253.8 ppm	254 ppm	+/- 1%
Nitric Oxide	8/26/2010 9/2/2010	255.1 ppm 254.0 ppm	255 ppm	+/- 1%
NOx			255 ppm	Reference Value Only
Sulfur Dioxide	8/26/2010 9/2/2010	248.9 ppm 249.7 ppm	249 ppm	+/- 1%

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

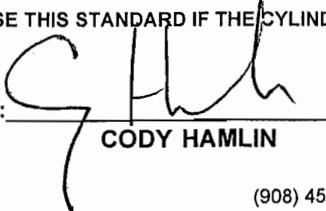
COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	CC-82186	504 ppm
Nitric Oxide	GMIS-1	CC-250174	1020 ppm
Sulfur Dioxide	GMIS-1	CC-118849	510 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	8/30/2010
Nitric Oxide	CAI-400-CLD	6L09004	Cheml	8/10/2010
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	8/26/2010

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST:


CODY HAMLIN

Linde Gas North America LLC

DATE: 9/2/2010

(908) 454-7455 Main (908) 252-0811 Fax
www.spectragases.com

THE LINDE GROUP

**CERTIFICATE OF ANALYSIS****EPA PROTOCOL MIXTURE
PROCEDURE # : G1**

CUSTOMER: Linde HAMMOND PLANT
SALES#: 107998857
PROD#: 1172309
P.O.# : 4501778098
MATERIAL#: 24089260
CERTIFICATION DATE: 03/25/2011
EXPIRATION DATE: 03/25/2013

CYLINDER # : CC-267376
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	03/18/2011	112.4 ppm	112.2 ppm	+/- 1%
	03/25/2011	112.0 ppm		
Nitric Oxide	03/18/2011	112.7 ppm	113.2 ppm	+/- 1%
	03/25/2011	113.8 ppm		
NOx			113.2 ppm	Reference Value Only
Sulfur Dioxide	03/18/2011	114.8 ppm	114.4 ppm	+/- 1%
	03/25/2011	114.0 ppm		

BALANCE Nitrogen**PREVIOUS CERTIFICATION DATES:** None**REFERENCE STANDARDS**

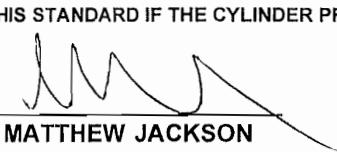
COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	CC-118482	502 ppm
Nitric Oxide	GMIS-1	CC-250092	250 ppm
Sulfur Dioxide	GMIS-1	CC-197153	493 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	03/01/2011
Nitric Oxide	CAI 400-CLD	6L09004	Cheml	3/17/2011
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	3/11/2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST:



Linde Gas North America LLC

DATE: 03/25/2011

20420

THE LINDE GROUP

**CERTIFICATE OF ANALYSIS****EPA PROTOCOL MIXTURE
PROCEDURE # : G1**

CUSTOMER: Linde Hammond Plant
SALES#: 108072150
PROD#: 1176156
P.O.# : 45017806046
MATERIAL#: 24086350
CERTIFICATION DATE: 04/27/2011
EXPIRATION DATE: 04/27/2013

CYLINDER # : SA-17929
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	04/20/2011	50.31 ppm	50.4 ppm	+/- 1%
	04/27/2011	50.42 ppm		
Nitric Oxide	04/20/2011	49.41 ppm	49.5 ppm	+/- 1%
	04/27/2011	49.55 ppm	49.5 ppm	Reference Value Only
Sulfur Dioxide	04/20/2011	50.44 ppm	50.2 ppm	+/- 1%
	04/27/2011	50.03 ppm		

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	NTRM-81679	CC-135124	101 ppm
Nitric Oxide	GMIS-1	CC-202692	98.8 ppm
Sulfur Dioxide	NTRM-81694	CC-162819	96.1 ppm

INSTRUMENTATION

COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	H0002L2Y	NDIR	03/28/2011
Nitric Oxide	CAI 400-CLD	6L09004	Cheml	4/26/2011
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	4/19/2011

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES.
DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST:

JUSTIN KUTZ

Linde Gas North America LLC

DATE: 04/27/2011

(908) 329-9700 Main (908) 329-9740 Fax
www.Lindeus.com

APPENDIX F

GAS ANALYZER SPECIFICATIONS

NO_2 , and NO_x concentrations to the front panel display, the analog outputs, and also makes the data available over the serial or ethernet connection.

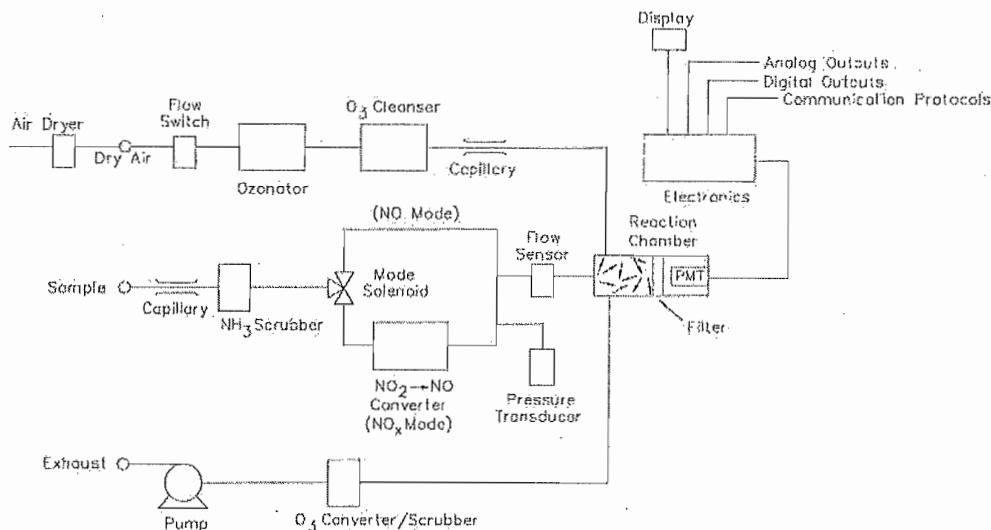


Figure 1-1. Model 42i Low Source Flow Schematic

Specifications

Table 1-1. Model 42i Low Source Specifications

Preset ranges	0-0.2, 0.5, 1, 2, 5, 10, 20, 50, 100 ppm 0-0.5, 1, 2, 5, 10, 20, 50, 100, 150 mg/m ³
Extended ranges	0-1, 2, 5, 10, 20, 50, 100, 200, 500 ppm 0-2, 5, 10, 20, 50, 100, 200, 500, 750 mg/m ³
Custom ranges	0-0.2 to 100 ppm (0-1 to 500 ppm in extended ranges) 0-0.5 to 150 mg/m ³ (0-2 to 750 mg/m ³ in extended ranges)
Zero noise	0.005 ppm RMS (60 second averaging time)
Lower detectable limit	0.01 ppm (60 second averaging time)
Zero drift (24 hour)	≈ 0.005 ppm
Span drift (24 hour)	± 1% full-scale
Response time (NO/NO _x mode)	15 sec (10 second averaging time) 85 sec (60 second averaging time) 305 sec (300 second averaging time)

Response time (NO mode)	15 sec (10 second averaging time) 65 sec (60 second averaging time) 305 sec (300 second averaging time)
Linearity	± 1% full-scale
Sample flow rate	≈ 25 cc/min. measured at atmospheric pressure
Operating temperature	15–35 °C (may be safely operated over the range of 0–45 °C)*
Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 300 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 55 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1 V, 5 V, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbps Ethernet connection, static or dynamic TCP/IP addressing

* In non condensing environments. Performance specifications based on operation in 15–35 °C range.

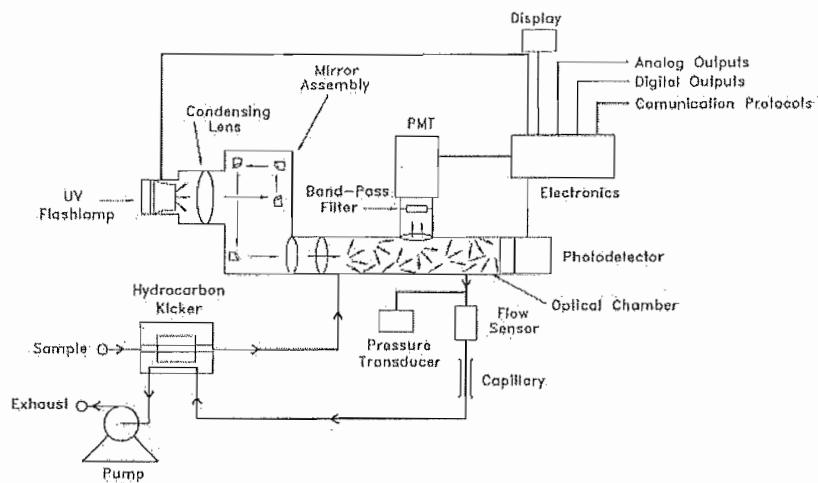


Figure 1-1. Model 43*i* Flow Schematic

Specifications

Table 1-1. Model 43*i* Specifications

Preset ranges	.0-0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10 ppm 0-0.2, 0.5, 1, 2, 5, 10, 20, 25 mg/m ³
Extended ranges	0-0.5, 1, 2, 5, 10, 20, 50, 100 ppm 0-2, 5, 10, 20, 50, 100, 200, 250 mg/m ³
Custom ranges	0-0.05 to 10 ppm {0-0.5 to 100 ppm in extended range} 0-0.2 to 25 mg/m ³ {0-2 to 250 mg/m ³ in extended range}
Zero noise	1.0 ppb RMS (10 second averaging time) 0.5 ppb RMS (60 second averaging time) 0.25 ppb RMS (300 second averaging time)
Lower detectable limit	2.0 ppb (10 second averaging time) 1.0 ppb (60 second averaging time) 0.5 ppb (300 second averaging time)
Zero drift (24 hour)	<1 ppb
Span drift	± 1% full-scale
Response time (in automatic mode)	80 sec (10 second averaging time) 110 sec (60 second averaging time) 320 sec (300 second averaging time)
Linearity	± 1% of full-scale

Sample flow rate	0.5 LPM (standard) 1 LPM (optional)
Interferences (tested at levels specified by EPA)	less than lower detectable limit except for the following: NO: < 3 ppb, tested at 500 ppb M-Xylene: tested at 200 ppb H ₂ O: tested at 2% of reading
Operating temperature	20–30 °C (may be safely operated over the range of 0–45 °C)*
Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 165 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 48 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (user selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, data bits, parity, and stop bits, protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbps Ethernet connection, static or dynamic TCP/IP addressing

* In non condensing environments. Performance specifications based on operation within 20–30 °C range.

Table 1-2. Model 43*i* Optional Permeation Oven Specifications

Temperature control	Single Point 45 °C
Temperature stability	± 0.1 °C
Warm-up time	1 hour (permeation device can take 24 to 48 hours to stabilize)
Carrier gas flow	≈ 70 scc/min
Chamber size	Accepts permeation tubes up to 9 cm in total length; 1 cm in diameter
Temperature range	20–30 °C
Physical dimensions	Contained inside the Model 43 <i>i</i>
Power requirements	120 VAC @ 50/60 Hz, 50 watts (in addition to the standard Model 43 <i>i</i>)
Weight	Approximately 5 lbs. (in addition to the standard Model 43 <i>i</i>)

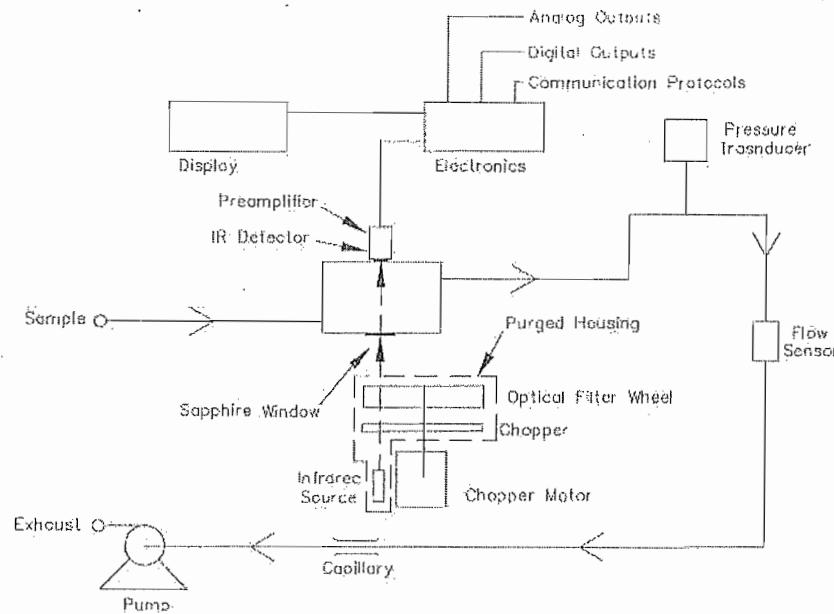


Figure 1-1. Model 410*i* Flow Schematic

Specifications

Table 1-1. Model 410*i* Specifications *CO₂*

Preset ranges	Standard: 0-200, 500, 1000, 2000, 5000, 10000 ppm High Level: 0-0.5, 1, 2, 5, 10, 20, 25%
Custom ranges	Standard: 0-200 to 10000 ppm High Level: 0-0.5 to 25%
Zero noise	Standard: 0.5 ppm RMS (60 second averaging time) High Level: 20 ppm RMS (60 second averaging time)
Minimum detectable limit	Standard: 1 ppm High Level: 40 ppm
Zero drift (24 hour)	± 1.0 ppm
Span drift (24 hour)	± 2% span concentration
Response time	90 seconds (30 second averaging time)
Linearity	± 1.5% of span (at concentrations of 10 to 100% of span)
Sample flow rate	1.0 LPM
Operating temperature	5-45 °C

Introduction
Specifications

Power requirements	100 VAC @ 50/60 Hz 115 VAC @ 50/60 Hz 220–240 VAC @ 50/60 Hz 275 watts
Physical dimensions	16.75" (W) X 8.62" (H) X 23" (D)
Weight	Approximately 39 lbs.
Analog outputs	6 voltage outputs; 0–100 mV, 1, 5, 10 V (User selectable), 5% of full-scale over/under range, 12 bit resolution, user selectable for measurement input
Digital outputs	1 power fail relay Form C, 10 digital relays Form A, user selectable alarm output, relay logic, 100 mA @ 200 VDC
Digital inputs	16 digital inputs, user select programmable, TTL level, pulled high
Serial Ports	1 RS-232 or RS-485 with two connectors, baud rate 1200–115200, Protocols: C-Link, MODBUS, and streaming data (all user selectable)
Ethernet connection	RJ45 connector for 10Mbps Ethernet connection, static or dynamic TCP/IP addressing

MODEL 1420 SERVOMEX PARAMAGNETIC O₂ ANALYZER SPECIFICATIONS

Repeatability:	Better than ± 0.2% O ₂ under constant conditions
Drift	Less than 0.2% O ₂ per week under constant conditions. (Excluding variation due to barometric pressure changes; reading is proportional to barometric pressure)
Outputs	
Display	3 ½ digit LCD reading 0.0 to 100.0% oxygen with over range capability
Output	0 to 1V (non-isolated) for 0 to 100% oxygen available on 'D' type connector located on the back panel of the instrument. Output impedance is less than 10 ohms.
Option	4 – 20mA isolated, Max impedance 500 ohms
Flow alarm output	Change over relay contact rated at 3A/115V ac, 1A/240V ac or 1A/28V dc. 4 sets of single pole changeover contacts. Alarm becomes active when sample gas flow through the analyzer fails
Sample Requirements	
Condition	Clean, dry gas with dew point 5 deg C below ambient temperature
Inlet pressure	0.5 to 3 psig (3.5 to 21kPa). Inlet pressure changes within this range will change the reading by less than 0.1% O ₂ . May be operated up to 10 psig (70kPa) with degraded stability
Flow rate	1.5 to 6 litres/minute approximately depending on sample pressure
Filtering	0.6 micron replaceable filter integral to the automatic flow control device.
Response time	Less than 15 secs. To 90% at an inlet pressure of 3 psig (21kPa)
Inlet/vent connections	¼ inch OD tube (stainless steel) suitable for 6mm ID flexible tubing or ¼ inch OD compression fittings.

Materials exposed to the sample	Stainless steel, Pyrex glass, brass, platinum, epoxy resin, viton, polypropylene and glass fibre filter
<u>Physical Characteristics</u>	
Case	Steel and aluminum finished in epoxy powder paint
Case Classification	IP 20 (IEC 529) when fitted into the Servomex 1400 series 19 inch case
Weight	10Kg (22 lb) approximately
<u>Electrical</u>	
AC Supply	110 to 120V AC or 220 to 240V AC, ±10%, 48 to 62Hz. Voltage selected by a voltage selector integral to the IEC supply plug
Power required	15VA maximum

APPENDIX G

CEM INSTRUMENT INFORMATION SHEET

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name:	<u>M PCC</u>		Plant Location:	<u>UNIT 9</u>	
Pollutant Gas Monitor Data:			Diluent Monitor Data:	<u>SEE</u>	<u>SO₂ F-FACTOR</u>
Vendor:	<u>THEER MO ENVIRONMENTAL</u>		Vendor:		
Model:	<u>42 INOX SIN 42 I 0510511561</u>		Model:		
CEM Location:	<u>B9 S4 SECTER</u>		CEM Location:		
Gas (es):	<input type="checkbox"/> SO ₂	<input checked="" type="checkbox"/> NO _x	Gas:	<input type="checkbox"/> O ₂	<input checked="" type="checkbox"/> CO ₂
Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive	Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive <input type="checkbox"/> Dilution
Installation Date:	<u>3-15-2005</u>		Installation Date:		
Start-Up Date:	<u>1-1-2006</u>		Start-Up Date:		
INSTRUMENT CERT: <u>03-07-2006</u>			Data Recording System:		
			<input type="checkbox"/> Strip Chart Recorder	<input checked="" type="checkbox"/> Data Logger System	<input type="checkbox"/> Data Logger System
			<input type="checkbox"/> Computer	<input type="checkbox"/> Computer	<input type="checkbox"/> Computer
Relative Accuracy Certification Units:			Output Units:		
<input type="checkbox"/> ppm, dry			<input type="checkbox"/> LB/106BTU by O ₂ F-Factor	<input type="checkbox"/> %O ₂ , dry	<input type="checkbox"/> %CO ₂ , dry
<input checked="" type="checkbox"/> ppm, wet			<input checked="" type="checkbox"/> LB/106BTU by CO ₂ F-Factor	<input type="checkbox"/> %O ₂ , wet	<input type="checkbox"/> %CO ₂ , wet
Span Value (ppm): <u>DIAUL PAN 6E</u>			Span Gas Values (% v/v):		
SO ₂			*****Oxygen*****		
NO _x <u>Low : 2.00</u>			Low		
CO			High		
			<u>***Carbon Dioxide***</u>		
			<u>10-07-07</u>		
			Signature of Person Responsible for Data		
			Date		

CEM Relative Accuracy Certification Instrument Information Sheet

Plant Name:	<u>MARSHALL INDUSTRIAL MPU</u>		Plant Location:	<u>UNIT 9</u>	
Pollutant Gas Monitor Data:					
Vendor:	<u>Thermo Environmental</u>		Diluent Monitor Data:	<u>Environmaatac</u>	
Model:	<u>431502</u>	S/N <u>431051051584</u>	Vendor:	<u>Thermo</u>	<u>4101051051584</u>
CEM Location:	<u>B9 S HECTER</u>		Model:	<u>410 TCO2</u>	S/N <u>4101051051584</u>
Gas (es):	<input checked="" type="checkbox"/> SO2	<input type="checkbox"/> NOx	CEM Location:	<u>B9 SHENTER</u>	
Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive	Gas:	<input type="checkbox"/> O2	<input checked="" type="checkbox"/> CO2
Installation Date:	<u>8-15-2005</u>		Type of System:	<input type="checkbox"/> In-Situ	<input type="checkbox"/> Dry-Extractive
Start-Up Date:	<u>1-1-2006</u>		Instillation Date:	<u>8-15-2005</u>	
Start-Up Date:	<u>1-1-2006</u>		Start-Up Date:	<u>1-1-2006</u>	
Start-Up Date:	<u>03-07-2006</u>		Start-Up Date:	<u>03-07-2006</u>	
Data Recording System:					
<input type="checkbox"/> Data Logger System <input checked="" type="checkbox"/> Data Logger System <input type="checkbox"/> Strip Chart Recorder <input type="checkbox"/> Computer <input checked="" type="checkbox"/> Computer					
Relative Accuracy Certification Units:					
<input type="checkbox"/> ppm, dry <input type="checkbox"/> LB/106BTU by O2 F-Factor <input checked="" type="checkbox"/> ppm, wet <input checked="" type="checkbox"/> LB/106BTU by CO2 F-Factor					
Span Value (ppm): <u>(Duct Raw E)</u>					
SO2	Low: <u>400</u>	High: <u>4000</u>	CO	Low: <u>0</u>	High: <u>20.00</u>
NOx					

Signature of Person Responsible for Data

Chris Reed

Date

03-17-07

INTERPOLL LABORATORIES, INC.
(763) 786-6020

Flow Monitor Relative Field Accuracy Instrument Information Sheet

Plant Name: MPC

Flow Monitor Data:

Vendor: UNITED SCAFFOLDING, INC.

Model: ULTRASONIC FLOW 150 SN 1500188

Location: B9 SELECTA & BREAK ROOM

Plant Location:	<u>CEN IT 9</u>	
Diluent Monitor Data:		
Vendor:		
Model:		
Location:		
Gas:	<input type="checkbox"/> O ₂	<input type="checkbox"/> CO ₂
Type of System:	<input checked="" type="checkbox"/> Ultrasonic	
Type of System:	<input type="checkbox"/> Differential Pressure	<input checked="" type="checkbox"/> Ultrasonic
Installation Date:	<u>8-15-2005</u>	
Start-Up Date:	<u>1-1-2006</u>	
Start-Up Date:	<u>CENT: 02-23-2006</u>	
Data Recording System:	<input checked="" type="checkbox"/> Data Logger System	
Data Recording System:	<input type="checkbox"/> Strip Chart Recorder	
Data Recording System:	<input checked="" type="checkbox"/> Computer	
Data Recording System:	<input type="checkbox"/> Data Logger System	
Data Recording System:	<input type="checkbox"/> Strip Chart Recorder	
Data Recording System:	<input checked="" type="checkbox"/> Computer	
Output Units:	<input type="checkbox"/> % O ₂ , dry	
Output Units:	<input type="checkbox"/> % O ₂ , wet	
Output Units:	<input type="checkbox"/> % CO ₂ , dry	<input type="checkbox"/> % CO ₂ , wet
Span Gas Values (% v/v):	*****Oxygen*****	
Span Gas Values (% v/v):	***Carbon Dioxide***	
Low	<u>10-17-07</u>	
High	<u>10-17-07</u>	

Date

Signature of Person Responsible for Data

John Reed

MPU00553

APPENDIX H

CEM COMPUTER PRINTOUTS

B9 Low flow Rate
Run 1

Average Data
Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/19/2011 23:00 Through 09/19/2011 23:10

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/19/11 23:00	4,886,340.0	29.33	172	341.7
09/19/11 23:01	4,902,974.0	29.33	173	341.6
09/19/11 23:02	4,882,613.0	29.34	173	341.5
09/19/11 23:03	4,921,707.0	29.33	174	341.5
09/19/11 23:04	4,954,094.0	29.35	173	341.6
09/19/11 23:05	4,981,780.0	29.33	174	341.5
09/19/11 23:06	4,929,243.0	29.34	172	341.6
09/19/11 23:07	4,929,325.0	29.33	171	341.8
09/19/11 23:08	4,972,046.0	29.32	170	341.7
09/19/11 23:09	5,007,062.0	29.32	172	341.4
09/19/11 23:10	5,000,642.0	29.32	171	341.5
Average	4,940,711.5	29.33	172	341.6
Minimum	4,882,613.0	29.32	170	341.4
Maximum	5,007,062.0	29.35	174	341.8
Summation	54,347,826.0	322.64	1,895	3,757.4
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/19/11 23:23

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low flow RSTA

Run 2

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/19/2011 23:35 Through 09/19/2011 23:45

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/19/11 23:35	4,818,120.0	29.33	168	342.5
09/19/11 23:36	4,902,840.0	29.32	167	342.4
09/19/11 23:37	4,926,044.0	29.35	167	342.3
09/19/11 23:38	4,834,422.0	29.32	167	342.1
09/19/11 23:39	4,775,662.0	29.34	172	342.1
09/19/11 23:40	4,854,932.0	29.33	172	341.8
09/19/11 23:41	4,884,598.0	29.33	170	341.6
09/19/11 23:42	4,934,285.0	29.31	168	341.7
09/19/11 23:43	4,916,324.0	29.33	169	341.7
09/19/11 23:44	4,851,612.0	29.33	170	342.1
09/19/11 23:45	4,795,655.0	29.33	171	342.5
Average	4,863,135.8	29.33	169	342.1
Minimum	4,775,662.0	29.31	167	341.6
Maximum	4,934,285.0	29.35	172	342.5
Summation	53,494,494.0	322.62	1,861	3,762.8
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/2011 00:00

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow Rates

Run 3

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 00:10 Through 09/20/2011 00:20

Time Online Criteria: 1 minute(s)

Source Parameter (Unit)	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B8TEMP (DEGFAHR)
09/20/11 00:10	4,865,236.0	29.33	170	342.7
09/20/11 00:11	4,842,335.0	29.34	169	342.8
09/20/11 00:12	4,830,945.0	29.32	168	342.6
09/20/11 00:13	4,873,820.0	29.32	167	342.3
09/20/11 00:14	4,884,027.0	29.33	168	342.2
09/20/11 00:15	4,853,573.0	29.32	170	342.1
09/20/11 00:16	4,800,048.0	29.33	174	342.0
09/20/11 00:17	4,789,910.0	29.34	171	342.1
09/20/11 00:18	4,827,072.0	29.32	171	342.2
09/20/11 00:19	4,839,220.0	29.34	169	342.4
09/20/11 00:20	4,830,963.0	29.34	167	342.8
Average	4,839,740.8	29.33	169	342.4
Minimum	4,789,910.0	29.32	167	342.0
Maximum	4,884,027.0	29.34	174	342.8
Summation	53,237,149.0	322.63	1,864	3,766.2
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 00:35

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow RATE

Run 4

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 00:45 Through 09/20/2011 00:55

Time Online Criteria: 1 minute(s)

Source	B9			
Parameter (Unit)	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 00:45	4,814,914.0	29.33	164	344.4
09/20/11 00:46	4,778,026.0	29.30	166	344.3
09/20/11 00:47	4,842,566.0	29.32	169	344.0
09/20/11 00:48	4,883,007.0	29.32	169	343.7
09/20/11 00:49	4,853,908.0	29.35	168	343.6
09/20/11 00:50	4,893,324.0	29.35	168	343.6
09/20/11 00:51	4,912,732.0	29.33	165	343.5
09/20/11 00:52	4,872,434.0	29.32	164	343.5
09/20/11 00:53	4,855,177.0	29.33	164	343.7
09/20/11 00:54	4,827,740.0	29.33	165	344.0
09/20/11 00:55	4,808,633.0	29.33	164	344.1
Average	4,849,314.6	29.33	166	343.9
Minimum	4,778,026.0	29.30	164	343.5
Maximum	4,912,732.0	29.35	169	344.4
Summation	53,342,461.0	322.61	1,826	3,782.4
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 01:05

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low flow RATA

Run 5

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 01:20 Through 09/20/2011 01:30

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 01:20	4,872,468.0	29.32	164	344.2
09/20/11 01:21	4,890,050.0	29.32	164	344.2
09/20/11 01:22	4,870,264.0	29.34	163	344.1
09/20/11 01:23	4,827,240.0	29.33	163	344.3
09/20/11 01:24	4,798,000.0	29.35	163	344.3
09/20/11 01:25	4,857,244.0	29.33	164	344.2
09/20/11 01:26	4,888,797.0	29.33	164	344.0
09/20/11 01:27	4,838,125.0	29.34	163	344.0
09/20/11 01:28	4,782,371.0	29.34	166	344.1
09/20/11 01:29	4,771,265.0	29.33	165	344.2
09/20/11 01:30	4,775,422.0	29.33	164	344.4
Average	4,833,749.6	29.33	164	344.2
Minimum	4,771,265.0	29.32	163	344.0
Maximum	4,890,050.0	29.35	166	344.4
Summation	53,171,246.0	322.66	1,803	3,786.0
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 01:42

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low flow RATA

Run 6

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 01:55 Through 09/20/2011 02:05

Time Online Criteria: 1 minute(s)

Source	B9				
	Parameter (Unit)	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 01:55		4,856,072.0	29.32	166	343.9
09/20/11 01:56		4,862,824.0	29.33	166	343.7
09/20/11 01:57		4,818,408.0	29.34	167	343.5
09/20/11 01:58		4,823,738.0	29.33	166	343.5
09/20/11 01:59		4,899,388.0	29.33	167	343.4
09/20/11 02:00		4,910,932.0	29.36	167	343.4
09/20/11 02:01		4,827,498.0	29.32	166	343.8
09/20/11 02:02		4,796,168.0	29.32	168	344.2
09/20/11 02:03		4,879,967.0	29.31	166	344.4
09/20/11 02:04		4,914,268.0	29.35	165	344.5
09/20/11 02:05		4,902,727.0	29.33	165	344.7
Average		4,862,908.2	29.33	166	343.9
Minimum		4,796,168.0	29.31	165	343.4
Maximum		4,914,268.0	29.36	168	344.7
Summation		53,491,990.0	322.64	1,829	3,783.0
Included Data Points		11	11	11	11
Total number of Data Points		11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/2011 02:17

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow RATA
Run 7

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 02:30 Through 09/20/2011 02:40

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 02:30	4,867,099.0	29.33	163	345.4
09/20/11 02:31	4,817,100.0	29.32	163	345.6
09/20/11 02:32	4,778,039.0	29.32	163	345.7
09/20/11 02:33	4,763,209.0	29.31	162	346.1
09/20/11 02:34	4,718,206.0	29.32	162	346.2
09/20/11 02:35	4,649,766.1	29.32	161	345.8
09/20/11 02:36	4,665,520.0	29.33	160	345.5
09/20/11 02:37	4,746,065.0	29.33	161	345.5
09/20/11 02:38	4,818,379.0	29.34	161	345.6
09/20/11 02:39	4,911,316.0	29.33	161	345.7
09/20/11 02:40	4,922,615.0	29.34	160	345.9
Average	4,787,028.6	29.33	162	345.7
Minimum	4,649,766.1	29.31	160	345.4
Maximum	4,922,615.0	29.34	163	346.2
Summation	52,657,314.1	322.59	1,777	3,803.0
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 02:52

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow RATA

Run 8

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 03:10 Through 09/20/2011 03:20

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 03:10	4,934,872.0	29.33	161	345.6
09/20/11 03:11	4,851,744.0	29.32	161	344.9
09/20/11 03:12	4,884,133.0	29.32	162	344.8
09/20/11 03:13	4,919,769.0	29.32	164	344.7
09/20/11 03:14	4,894,118.0	29.34	167	344.4
09/20/11 03:15	4,835,638.0	29.33	165	344.1
09/20/11 03:16	4,905,599.0	29.31	168	344.0
09/20/11 03:17	4,925,275.0	29.31	166	344.2
09/20/11 03:18	4,812,045.0	29.32	165	344.5
09/20/11 03:19	4,745,464.0	29.33	164	344.8
09/20/11 03:20	4,867,041.0	29.31	163	345.0
Average	4,870,518.0	29.32	164	344.6
Minimum	4,745,464.0	29.31	161	344.0
Maximum	4,934,872.0	29.34	168	345.6
Summation	53,575,698.0	322.54	1,806	3,791.0
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/2011 03:31

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow RATA

Run 9

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 03:45 Through 09/20/2011 03:55

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 03:45	4,780,261.0	29.32	161	345.6
09/20/11 03:46	4,831,095.0	29.34	161	345.6
09/20/11 03:47	4,908,680.0	29.32	161	345.7
09/20/11 03:48	4,970,322.0	29.34	161	345.8
09/20/11 03:49	4,965,483.0	29.32	161	345.7
09/20/11 03:50	4,886,483.0	29.31	162	345.5
09/20/11 03:51	4,806,051.0	29.34	162	345.3
09/20/11 03:52	4,831,121.0	29.33	162	345.4
09/20/11 03:53	4,933,568.0	29.32	162	345.4
09/20/11 03:54	4,913,306.0	29.31	162	345.3
09/20/11 03:55	4,895,186.0	29.31	162	345.5
Average	4,883,777.8	29.32	162	345.5
Minimum	4,780,261.0	29.31	161	345.3
Maximum	4,970,322.0	29.34	162	345.8
Summation	53,721,556.0	322.56	1,777	3,800.8
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 04:06

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Low Flow RATA

Run 10

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 04:20 Through 09/20/2011 04:30

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 04:20	4,996,736.0	29.31	161	346.0
09/20/11 04:21	4,818,793.0	29.32	162	345.8
09/20/11 04:22	4,747,068.0	29.32	162	345.7
09/20/11 04:23	4,967,492.0	29.33	163	346.6
09/20/11 04:24	4,915,716.0	29.33	162	346.5
09/20/11 04:25	4,843,583.0	29.31	162	346.5
09/20/11 04:26	4,796,291.0	29.32	161	346.6
09/20/11 04:27	4,836,997.0	29.33	160	346.4
09/20/11 04:28	4,817,528.0	29.31	161	346.3
09/20/11 04:29	4,771,977.0	29.34	160	346.2
09/20/11 04:30	4,800,635.0	29.32	160	346.1
Average	4,846,619.6	29.32	161	346.2
Minimum	4,747,068.0	29.31	160	345.7
Maximum	4,996,736.0	29.34	163	346.6
Summation	53,312,816.0	322.54	1,774	3,808.7
Included Data Points	11	11	11	11
Total number of Data Points	11	11	11	11

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 04:42

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Gas Rates

Run 1

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/19/2011 23:00 Through 09/19/2011 23:20
Time Online Criteria: 1 minute(s)

Source	Parameter (Unit)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9SO2#M (#/MMBTU)	B9STEAM (KJ/BSFHr)
09/19/11 23:00	10.8	35.8	91.2	1,833.0	0.073	0.257	172	
09/19/11 23:01	10.8	34.7	95.0	1,833.0	0.070	0.268	173	
09/19/11 23:02	10.8	33.8	100.2	1,833.0	0.068	0.282	173	
09/19/11 23:03	10.9	33.5	102.2	1,833.0	0.067	0.285	174	
09/19/11 23:04	10.7	35.0	98.4	1,833.0	0.072	0.280	173	
09/19/11 23:05	10.7	35.4	98.1	1,833.0	0.072	0.279	174	
09/19/11 23:06	10.8	34.0	98.8	1,833.0	0.069	0.278	172	
09/19/11 23:07	10.7	34.6	98.2	1,833.0	0.071	0.279	171	
09/19/11 23:08	10.8	34.8	95.5	1,833.0	0.071	0.269	170	
09/19/11 23:09	10.6	33.3	96.0	1,833.0	0.069	0.276	172	
09/19/11 23:10	10.6	33.3	98.7	1,833.0	0.069	0.283	171	
09/19/11 23:11	10.7	32.8	100.7	1,833.0	0.067	0.286	173	
09/19/11 23:12	10.8	34.5	96.1	1,833.0	0.070	0.271	174	
09/19/11 23:13	11.0	33.9	95.8	1,833.0	0.067	0.285	173	
09/19/11 23:14	10.9	33.1	97.6	1,833.0	0.066	0.272	174	
09/19/11 23:15	11.0	35.0	93.8	1,833.0	0.070	0.289	175	
09/19/11 23:16	11.0	35.6	94.3	1,833.0	0.070	0.281	174	
09/19/11 23:17	10.9	35.8	94.5	1,833.0	0.072	0.284	172	
09/19/11 23:18	11.0	37.1	90.3	1,833.0	0.074	0.250	170	
09/19/11 23:19	10.9	37.4	88.7	1,833.0	0.075	0.248	170	
09/19/11 23:20	10.8	38.8	90.1	1,833.0	0.079	0.284	171	
<hr/>								
Average	10.8	34.8	95.9	1,833.0	0.071	0.270	172	
Minimum	10.6	32.8	88.7	1,833.0	0.066	0.248	170	
Maximum	11.0	38.8	102.2	1,833.0	0.079	0.286	175	
Summation	227.2	731.6	2,014.2	38,493.0	1,481	5,666	3,621	
Included Data Points	21	21	21	21	21	21	21	
Total number of Data Points	21	21	21	21	21	21	21	

F = Unit Offline E = Exceedance C = Calibration S = Substituted
Report Generated: 09/19/11 23:22

M = Maintenance T = Out Of Control
Report Version 3.0.0.806

* = Suspect
STACKVSION-SVR/plantadmin

MPU00565

B9 Gas Rate
Run 2

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/19/2011 23:35 Through 09/19/2011 23:55
Time Online Criteria: 1 minute(s)

Source	B9						
	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFFACT (MMBTU/CF)	B9NOx4M (#/MMBTU)	B9SO2H4M (#/MMBTU)	B9STEAM (KLBS/Hr)
09/19/11 23:35	10.7	37.1	94.2	1,833.0	0.076	0.268	168
09/19/11 23:36	10.6	36.4	90.4	1,833.0	0.075	0.259	167
09/19/11 23:37	10.7	38.5	90.2	1,833.0	0.079	0.257	167
09/19/11 23:38	10.7	39.1	90.1	1,833.0	0.080	0.256	167
09/19/11 23:39	10.7	38.6	90.4	1,833.0	0.079	0.257	172
09/19/11 23:40	10.9	35.8	99.6	1,833.0	0.072	0.278	172
09/19/11 23:41	10.8	35.4	102.2	1,833.0	0.072	0.288	170
09/19/11 23:42	10.8	36.9	100.8	1,833.0	0.075	0.284	168
09/19/11 23:43	10.8	37.4	99.2	1,833.0	0.076	0.279	168
09/19/11 23:44	10.7	38.0	97.2	1,833.0	0.078	0.276	170
09/19/11 23:45	10.7	38.4	95.3	1,833.0	0.079	0.271	171
09/19/11 23:46	10.6	37.6	94.7	1,833.0	0.078	0.272	171
09/19/11 23:47	10.8	36.8	99.4	1,833.0	0.075	0.280	170
09/19/11 23:48	10.7	36.5	99.3	1,833.0	0.075	0.282	171
09/19/11 23:49	10.7	36.2	101.8	1,833.0	0.074	0.289	171
09/19/11 23:50	10.8	36.5	100.7	1,833.0	0.074	0.284	171
09/19/11 23:51	10.7	38.1	95.2	1,833.0	0.078	0.271	170
09/19/11 23:52	10.8	38.2	95.5	1,833.0	0.077	0.269	169
09/19/11 23:53	10.6	38.0	93.3	1,833.0	0.078	0.268	169
09/19/11 23:54	10.8	37.1	94.8	1,833.0	0.075	0.267	167
09/19/11 23:55	10.9	36.9	95.4	1,833.0	0.074	0.266	168
Average	10.7	37.3	96.2	1,833.0	0.076	0.272	169
Minimum	10.6	35.4	90.1	1,833.0	0.072	0.256	167
Maximum	10.9	39.1	102.2	1,833.0	0.080	0.289	172
Summation	225.5	783.5	2,019.7	38,493.0	1,599	5.721	3,558
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted
Report Generated: 09/19/11 23:57 M = Maintenance T = Out Of Control
* = Suspect

Report Version 3.0.0806

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1 of 1

B9 Gas Rates

Run 3

Average Data
 Plant: Manitowoc Public Utilities
 Interval: 1 Minute

Type: Roll
 Report Period: 09/20/2011 00:10 Through 09/20/2011 00:30
 Time Online Criteria: 1 minute(s)

Source	Parameter (Unit)	B9				B9SO2#M (#AMMBTU)	B9STEAM (KLBS/Hr)
		B9CO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)		
09/20/11 00:10	10.7	39.5	86.3	1,833.0	0.081	0.245	170
09/20/11 00:11	10.8	38.8	88.8	1,833.0	0.079	0.250	169
09/20/11 00:12	10.9	38.5	90.2	1,833.0	0.077	0.252	168
09/20/11 00:13	10.8	38.5	91.0	1,833.0	0.078	0.256	167
09/20/11 00:14	10.9	37.6	93.5	1,833.0	0.075	0.261	168
09/20/11 00:15	10.8	39.5	90.2	1,833.0	0.080	0.254	170
09/20/11 00:16	10.8	39.8	89.0	1,833.0	0.081	0.251	174
09/20/11 00:17	10.9	38.8	88.9	1,833.0	0.078	0.248	171
09/20/11 00:18	10.8	39.3	87.9	1,833.0	0.080	0.248	171
09/20/11 00:19	10.7	41.1	86.1	1,833.0	0.084	0.245	169
09/20/11 00:20	10.6	40.7	86.3	1,833.0	0.084	0.248	167
09/20/11 00:21	10.6	41.9	83.2	1,833.0	0.087	0.239	165
09/20/11 00:22	10.6	42.6	84.6	1,833.0	0.087	0.243	166
09/20/11 00:23	10.6	42.4	83.3	1,833.0	0.088	0.239	169
09/20/11 00:24	10.7	44.7	72.2	1,833.0	0.091	0.205	171
09/20/11 00:25	10.6	42.5	78.7	1,833.0	0.088	0.226	168
09/20/11 00:26	10.5	43.1	82.6	1,833.0	0.090	0.239	167
09/20/11 00:27	10.5	43.1	85.8	1,833.0	0.090	0.249	165
09/20/11 00:28	10.4	42.1	86.7	1,833.0	0.089	0.254	164
09/20/11 00:29	10.4	41.9	89.1	1,833.0	0.088	0.261	167
09/20/11 00:30	10.4	41.4	88.4	1,833.0	0.087	0.259	167
Average	10.7	40.8	86.3	1,833.0	0.084	0.246	168
Minimum	10.4	37.6	72.2	1,833.0	0.075	0.205	164
Maximum	10.9	44.7	93.5	1,833.0	0.091	0.261	174
Summation	224.0	857.2	1,812.8	38,493.0	1.762	5,172	3,532
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted I = Invalid M = Maintenance T = Out Of Control
 Report Generated: 09/20/11 00:34 Report Version 3.0.0.0806 STACKVISION-SVR\plantadmin

* = Suspect
 1 of 1

B9 Gas Rates

Run 4

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute

Type: Roll
Report Period: 09/20/2011 00:45 Through 09/20/2011 01:05
Time Online Criteria: 1 minute(s)

Source	Parameter (Unit)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/JCF)	B9NOX#M (#/MMBTU)	B9SO2#M (#/MMBTU)	B9STEAM (KLBS/Hr)
B9								
09/20/11 00:45		10.4	38.4	91.1	1,833.0	0.081	0.267	164
09/20/11 00:46		10.4	37.9	91.5	1,833.0	0.080	0.268	166
09/20/11 00:47		10.5	36.9	93.0	1,833.0	0.077	0.270	169
09/20/11 00:48		10.5	37.8	90.4	1,833.0	0.079	0.262	169
09/20/11 00:49		10.6	37.5	92.0	1,833.0	0.077	0.264	168
09/20/11 00:50		10.5	37.0	90.3	1,833.0	0.077	0.262	168
09/20/11 00:51		10.6	38.3	89.8	1,833.0	0.079	0.258	165
09/20/11 00:52		10.5	38.0	90.0	1,833.0	0.079	0.261	164
09/20/11 00:53		10.5	37.1	93.1	1,833.0	0.077	0.270	164
09/20/11 00:54		10.5	38.0	94.6	1,833.0	0.079	0.274	165
09/20/11 00:55		10.4	37.1	94.3	1,833.0	0.078	0.276	164
09/20/11 00:56		10.5	37.9	91.9	1,833.0	0.079	0.266	166
09/20/11 00:57		10.5	37.2	92.1	1,833.0	0.078	0.267	170
09/20/11 00:58		10.5	36.7	93.2	1,833.0	0.076	0.270	169
09/20/11 00:59		10.6	36.8	92.4	1,833.0	0.076	0.265	169
09/20/11 01:00		10.4	37.4	86.2	1,833.0	0.079	0.252	167
09/20/11 01:01		10.4	36.3	97.8	1,833.0	0.076	0.286	165
09/20/11 01:02		10.4	35.7	98.1	1,833.0	0.075	0.287	165
09/20/11 01:03		10.4	35.8	99.6	1,833.0	0.075	0.291	164
09/20/11 01:04		10.5	35.6	100.3	1,833.0	0.074	0.291	164
09/20/11 01:05		10.4	35.6	98.8	1,833.0	0.075	0.289	163
Average		10.5	37.1	93.4	1,833.0	0.077	0.271	166
Minimum		10.4	35.6	86.2	1,833.0	0.074	0.252	163
Maximum		10.6	38.4	100.3	1,833.0	0.081	0.291	170
Summation		220.0	779.0	1,960.5	38,433.0	1.626	5,696	3,488
Included Data Points	21	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted I = Invalid M = Maintenance T = Out Of Control
* = Suspect

Report Generated: 09/20/11 01:08

Report Version 3.0.0806

1 of 1

B9 Gas Rate
Run 5

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 01:20 Through 09/20/2011 01:40

Time Online Criteria: 1 minute(s)

Source	Parameter (Unit)	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	B9SO2HM (#/MMBTU)	B9STEAM (KLBS/Hr)
09/20/11 01:20	10.5	39.7	81.6	1,833.0	0.083	0.236	164	
09/20/11 01:21	10.6	39.3	81.6	1,833.0	0.081	0.234	164	
09/20/11 01:22	10.4	38.8	81.9	1,833.0	0.082	0.240	163	
09/20/11 01:23	10.4	39.4	84.8	1,833.0	0.083	0.248	163	
09/20/11 01:24	10.4	38.2	86.4	1,833.0	0.080	0.253	163	
09/20/11 01:25	10.5	38.1	87.0	1,833.0	0.079	0.252	164	
09/20/11 01:26	10.5	38.1	89.2	1,833.0	0.079	0.258	164	
09/20/11 01:27	10.4	36.8	90.2	1,833.0	0.077	0.264	163	
09/20/11 01:28	10.5	37.5	92.9	1,833.0	0.078	0.269	166	
09/20/11 01:29	10.5	36.7	95.3	1,833.0	0.076	0.276	165	
09/20/11 01:30	10.5	37.6	91.6	1,833.0	0.078	0.265	164	
09/20/11 01:31	10.6	37.2	90.6	1,833.0	0.077	0.260	165	
09/20/11 01:32	10.5	38.6	86.3	1,833.0	0.080	0.250	165	
09/20/11 01:33	10.6	38.4	86.6	1,833.0	0.079	0.249	164	
09/20/11 01:34	10.5	37.6	86.2	1,833.0	0.078	0.250	164	
09/20/11 01:35	10.5	37.0	89.1	1,833.0	0.077	0.258	164	
09/20/11 01:36	10.6	36.9	92.4	1,833.0	0.076	0.265	163	
09/20/11 01:37	10.5	36.9	90.8	1,833.0	0.077	0.263	163	
09/20/11 01:38	10.7	38.0	85.8	1,833.0	0.078	0.244	163	
09/20/11 01:39	10.6	36.0	85.3	1,833.0	0.074	0.245	163	
09/20/11 01:40	10.6	36.2	97.1	1,833.0	0.075	0.279	163	
Included Data Points								
Total number of Data Points	21	21	21	21	21	21	21	21

Average
Minimum
Maximum
Summation

10.5
10.4
10.7
220.9

37.8
36.0
39.7
793.0

88.2
81.6
97.1
1,852.7

1,833.0
1,833.0
1,833.0
36,493.0

0.078
0.074
0.083
1,647

0.255
0.234
0.279
5,358

164
163
166
3,440

M = Maintenance
S = Substituted
T = Out Of Control

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* = Suspect

F = Unit Offline
E = Exceedance
C = Calibration
Report Generated: 09/20/11 01:41
Report Version 3.0.0.0806

MPU00569

Plant: Manitowoc Public Utilities
Interval: 1 Minute
Type: Roll
Report Period: 09/20/2011 01:20 Through 09/20/2011 01:40
Time Online Criteria: 1 minute(s)

1 of 1

B9 Gas RATA

Run 6

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 01:55 Through 09/20/2011 02:15

Time Online Criteria: 1 minute(s)

Source	B9				
Parameter (Unit)	B9CO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)
					B9STEAM (KLBS/HR)

09/20/2011 01:55	10.7	37.8	88.0	1,833.0	0.077	0.250	166
09/20/2011 01:56	10.7	38.3	83.8	1,833.0	0.078	0.238	166
09/20/2011 01:57	10.7	38.9	76.4	1,833.0	0.080	0.217	167
09/20/2011 01:58	10.8	38.0	83.1	1,833.0	0.077	0.234	166
09/20/2011 01:59	10.8	38.3	83.4	1,833.0	0.078	0.235	167
09/20/2011 02:00	10.8	40.0	81.3	1,833.0	0.081	0.229	167
09/20/2011 02:01	10.5	38.7	82.7	1,833.0	0.081	0.240	166
09/20/2011 02:02	10.5	39.0	84.2	1,833.0	0.081	0.244	168
09/20/2011 02:03	10.6	38.2	85.4	1,833.0	0.079	0.245	166
09/20/2011 02:04	10.6	38.3	84.7	1,833.0	0.079	0.243	165
09/20/2011 02:05	10.6	39.9	83.2	1,833.0	0.082	0.239	165
09/20/2011 02:06	10.5	40.3	78.2	1,833.0	0.084	0.227	164
09/20/2011 02:07	10.6	41.4	74.7	1,833.0	0.085	0.214	166
09/20/2011 02:08	10.5	43.0	71.2	1,833.0	0.090	0.206	168
09/20/2011 02:09	10.5	44.3	69.7	1,833.0	0.092	0.202	167
09/20/2011 02:10	10.6	44.8	70.3	1,833.0	0.092	0.202	165
09/20/2011 02:11	10.4	44.7	67.3	1,833.0	0.094	0.197	163
09/20/2011 02:12	10.4	45.7	68.4	1,833.0	0.096	0.200	162
09/20/2011 02:13	10.3	46.0	69.4	1,833.0	0.098	0.205	161
09/20/2011 02:14	10.2	45.5	68.1	1,833.0	0.098	0.203	161
09/20/2011 02:15	10.3	44.7	73.3	1,833.0	0.095	0.217	161
Average	10.6	41.2	77.5	1,833.0	0.086	0.223	
Minimum	10.2	37.8	67.3	1,833.0	0.077	0.197	
Maximum	10.8	46.0	88.0	1,833.0	0.098	0.250	
Summation	221.6	865.8	1,626.8	38,493.0	1,797	4,687	3,467
Included Data Points	21	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21	21

Average
Minimum
Maximum
Summation

Included Data Points

Total number of Data Points

10.6
10.2
10.8
221.6

41.2
37.8
46.0
865.8

77.5
67.3
88.0
1,626.8

1,833.0
1,833.0
1,833.0
38,493.0

0.086
0.077
0.098
1,797

M = Maintenance S = Substituted I = Invalid T = Out Of Control

MPU00570

F = Unit Offline E = Exceedance C = Calibration S = Substituted I = Invalid T = Out Of Control

Report Generated: 09/20/11 02:18

Report Version 3.0.0806

* = Suspect
STACKVISION-SV/plantadmin
1 of 1

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 02:30 Through 09/20/2011 02:50

Time Online Criteria: 1 minute(s)

Source	B9				
	B9CPCCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFFACT (MMBTU/JCF)	B9NOX4HM (#/MMBTU)
09/20/2011 02:30	10.4	44.3	76.1	1,833.0	0.093
09/20/2011 02:31	10.3	44.1	77.9	1,833.0	0.094
09/20/2011 02:32	10.3	43.9	81.3	1,833.0	0.093
09/20/2011 02:33	10.1	43.5	81.3	1,833.0	0.094
09/20/2011 02:34	10.3	42.0	85.3	1,833.0	0.089
09/20/2011 02:35	10.4	41.0	87.3	1,833.0	0.086
09/20/2011 02:36	10.4	40.4	86.5	1,833.0	0.089
09/20/2011 02:37	10.4	42.1	82.4	1,833.0	0.089
09/20/2011 02:38	10.2	42.2	81.8	1,833.0	0.091
09/20/2011 02:39	10.3	42.9	81.1	1,833.0	0.091
09/20/2011 02:40	10.2	41.2	84.3	1,833.0	0.088
09/20/2011 02:41	10.3	40.5	88.5	1,833.0	0.086
09/20/2011 02:42	10.4	40.3	89.5	1,833.0	0.085
09/20/2011 02:43	10.3	40.0	89.7	1,833.0	0.085
09/20/2011 02:44	10.3	41.2	90.8	1,833.0	0.088
09/20/2011 02:45	10.2	40.1	91.6	1,833.0	0.086
09/20/2011 02:46	10.4	40.1	93.0	1,833.0	0.084
09/20/2011 02:47	10.3	40.3	93.4	1,833.0	0.086
09/20/2011 02:48	10.4	40.1	93.3	1,833.0	0.084
09/20/2011 02:49	10.5	41.0	90.7	1,833.0	0.085
09/20/2011 02:50	10.4	39.5	89.5	1,833.0	0.083
Average	10.3	41.5	86.4	1,833.0	0.088
Minimum	10.1	39.5	76.1	1,833.0	0.083
Maximum	10.5	44.3	93.4	1,833.0	0.094
Summation	216.8	870.7	1,815.3	38,493.0	1.845
Included Data Points	21	21	21	21	21
Total number of Data Points	21	21	21	21	21

Source	B9				
	B9CPCCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFFACT (MMBTU/JCF)	B9NOX4HM (#/MMBTU)
09/20/2011 02:30	10.4	44.3	76.1	1,833.0	0.093
09/20/2011 02:31	10.3	44.1	77.9	1,833.0	0.094
09/20/2011 02:32	10.3	43.9	81.3	1,833.0	0.093
09/20/2011 02:33	10.1	43.5	81.3	1,833.0	0.094
09/20/2011 02:34	10.3	42.0	85.3	1,833.0	0.089
09/20/2011 02:35	10.4	41.0	87.3	1,833.0	0.086
09/20/2011 02:36	10.4	40.4	86.5	1,833.0	0.089
09/20/2011 02:37	10.4	42.1	82.4	1,833.0	0.089
09/20/2011 02:38	10.2	42.2	81.8	1,833.0	0.091
09/20/2011 02:39	10.3	42.9	81.1	1,833.0	0.091
09/20/2011 02:40	10.2	41.2	84.3	1,833.0	0.088
09/20/2011 02:41	10.3	40.5	88.5	1,833.0	0.086
09/20/2011 02:42	10.4	40.3	89.5	1,833.0	0.085
09/20/2011 02:43	10.3	40.0	89.7	1,833.0	0.085
09/20/2011 02:44	10.3	41.2	90.8	1,833.0	0.088
09/20/2011 02:45	10.2	40.1	91.6	1,833.0	0.086
09/20/2011 02:46	10.4	40.1	93.0	1,833.0	0.084
09/20/2011 02:47	10.3	40.3	93.4	1,833.0	0.086
09/20/2011 02:48	10.4	40.1	93.3	1,833.0	0.084
09/20/2011 02:49	10.5	41.0	90.7	1,833.0	0.085
09/20/2011 02:50	10.4	39.5	89.5	1,833.0	0.083
Average	10.3	41.5	86.4	1,833.0	0.088
Minimum	10.1	39.5	76.1	1,833.0	0.083
Maximum	10.5	44.3	93.4	1,833.0	0.094
Summation	216.8	870.7	1,815.3	38,493.0	1.845
Included Data Points	21	21	21	21	21
Total number of Data Points	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted M = Maintenance T = Out Of Control
 * = Suspect
 Report Generated: 09/20/11 02:51
 Report Version 3.0.0806
 StackVSION-SVR/plantadmin

Average Data

Plant: Manitowoc Public Utilities
Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 03:10 Through 09/20/2011 03:30

Time Online Criteria: 1 minute(s)

Source	B9					B9STEAM (KLBS/Hr)
	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#FM (#/MMBTU)	
09/20/2011 03:10	10.4	41.2	71.5	1,833.0	0.087	209
09/20/2011 03:11	10.5	39.2	84.6	1,833.0	0.082	245
09/20/2011 03:12	10.5	39.1	90.8	1,833.0	0.081	263
09/20/2011 03:13	10.5	38.5	92.5	1,833.0	0.080	268
09/20/2011 03:14	10.7	36.7	97.3	1,833.0	0.075	277
09/20/2011 03:15	10.5	37.6	92.6	1,833.0	0.078	268
09/20/2011 03:16	10.5	39.5	88.3	1,833.0	0.082	256
09/20/2011 03:17	10.4	38.9	90.6	1,833.0	0.082	265
09/20/2011 03:18	10.4	38.8	92.6	1,833.0	0.082	271
09/20/2011 03:19	10.6	39.8	93.9	1,833.0	0.082	270
09/20/2011 03:20	10.5	41.0	92.8	1,833.0	0.085	269
09/20/2011 03:21	10.5	41.0	92.7	1,833.0	0.085	269
09/20/2011 03:22	10.4	40.7	88.5	1,833.0	0.086	259
09/20/2011 03:23	10.3	41.7	88.7	1,833.0	0.089	262
09/20/2011 03:24	10.3	40.9	92.1	1,833.0	0.087	272
09/20/2011 03:25	10.3	39.5	94.8	1,833.0	0.084	280
09/20/2011 03:26	10.5	40.8	92.0	1,833.0	0.085	267
09/20/2011 03:27	10.3	41.7	89.3	1,833.0	0.089	264
09/20/2011 03:28	10.3	42.3	87.5	1,833.0	0.090	258
09/20/2011 03:29	10.3	42.2	88.3	1,833.0	0.090	261
09/20/2011 03:30	10.2	43.0	88.6	1,833.0	0.092	264
Average	10.4	40.2	90.0	1,833.0	0.084	263
Minimum	10.2	36.7	71.5	1,833.0	0.075	209
Maximum	10.7	43.0	97.3	1,833.0	0.092	280
Summation	218.9	844.1	1,890.0	38,493.0	1,773	3,435
Included Data Points	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 03:45 Through 09/20/2011 04:05

Time Online Criteria: 1 minute(s)

B9 Gas DATA
Run 9

Source	B9					
	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#MMBTU)	B9SO2#M (#MMBTU)
09/20/2011 03:45	10.3	41.7	85.2	1,833.0	0.089	0.252
09/20/2011 03:46	10.3	42.1	88.4	1,833.0	0.089	0.261
09/20/2011 03:47	10.1	41.2	88.2	1,833.0	0.089	0.266
09/20/2011 03:48	10.2	39.6	94.9	1,833.0	0.085	0.283
09/20/2011 03:49	10.2	38.7	98.2	1,833.0	0.083	0.293
09/20/2011 03:50	10.3	39.1	98.1	1,833.0	0.083	0.290
09/20/2011 03:51	10.4	38.8	97.3	1,833.0	0.082	0.285
09/20/2011 03:52	10.3	39.1	93.8	1,833.0	0.083	0.277
09/20/2011 03:53	10.3	39.6	91.9	1,833.0	0.084	0.271
09/20/2011 03:54	10.3	40.0	88.4	1,833.0	0.085	0.261
09/20/2011 03:55	10.3	41.5	88.6	1,833.0	0.088	0.262
09/20/2011 03:56	10.4	42.9	84.3	1,833.0	0.090	0.247
09/20/2011 03:57	10.3	43.6	80.1	1,833.0	0.093	0.237
09/20/2011 03:58	10.2	43.6	84.1	1,833.0	0.094	0.251
09/20/2011 03:59	10.2	43.4	85.8	1,833.0	0.093	0.256
09/20/2011 04:00	10.2	43.8	82.5	1,833.0	0.094	0.246
09/20/2011 04:01	10.3	43.5	82.6	1,833.0	0.092	0.244
09/20/2011 04:02	10.1	43.4	79.8	1,833.0	0.094	0.240
09/20/2011 04:03	10.2	43.6	79.3	1,833.0	0.094	0.237
09/20/2011 04:04	10.0	41.7	82.9	1,833.0	0.091	0.252
09/20/2011 04:05	10.0	42.2	84.6	1,833.0	0.092	0.257
Average	10.2	41.6	87.6	1,833.0	0.089	0.260
Minimum	10.0	38.7	79.3	1,833.0	0.082	0.237
Maximum	10.4	43.8	98.2	1,833.0	0.094	0.293
Summation	214.9	873.1	1,839.0	38,493.0	1.867	5,468
Included Data Points	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21

	M = Maintenance	S = Substituted	F = Unit Offline	E = Exceedance	C = Calibration	Report Version 3.0.0806	STACKVISION-SVR\plantadmin	* == Suspect

B9 Gas RATA

Run 10

Average Data
 Plant: Manitowoc Public Utilities
 Interval: 1 Minute

Type: Roll
 Report Period: 09/20/2011 04:20 Through 09/20/2011 04:40
 Time Online Criteria: 1 minute(s)

Source	B9					B9STEAM (KLBS/Hr)
	B9CPCO2 (PERCENT)	B9CPNOX (PPM)	B9CPSO2 (PPM)	B9FFACT (MMBTU/CF)	B9NOX#M (#/MMBTU)	
09/20/11 04:20	10.1	43.0	86.9	1,833.0	0.093	0.259
09/20/11 04:21	10.2	44.2	81.7	1,833.0	0.095	0.244
09/20/11 04:22	10.1	45.1	78.1	1,833.0	0.098	0.235
09/20/11 04:23	10.1	43.0	87.2	1,833.0	0.093	0.263
09/20/11 04:24	10.0	40.8	97.4	1,833.0	0.089	0.296
09/20/11 04:25	10.0	40.0	107.2	1,833.0	0.088	0.326
09/20/11 04:26	10.1	39.1	109.5	1,833.0	0.085	0.330
09/20/11 04:27	10.1	38.8	108.5	1,833.0	0.084	0.327
09/20/11 04:28	10.2	40.1	103.8	1,833.0	0.086	0.310
09/20/11 04:29	10.2	40.5	98.2	1,833.0	0.087	0.293
09/20/11 04:30	10.1	40.8	97.2	1,833.0	0.088	0.293
09/20/11 04:31	10.1	38.6	100.4	1,833.0	0.084	0.302
09/20/11 04:32	10.0	38.1	103.6	1,833.0	0.083	0.315
09/20/11 04:33	10.0	37.8	109.1	1,833.0	0.083	0.332
09/20/11 04:34	10.0	36.5	113.2	1,833.0	0.080	0.344
09/20/11 04:35	10.1	36.4	113.5	1,833.0	0.079	0.342
09/20/11 04:36	10.1	37.1	111.3	1,833.0	0.080	0.335
09/20/11 04:37	10.1	38.1	106.8	1,833.0	0.083	0.322
09/20/11 04:38	10.3	37.2	106.5	1,833.0	0.079	0.315
09/20/11 04:39	10.2	37.2	102.9	1,833.0	0.080	0.307
09/20/11 04:40	10.3	38.2	102.1	1,833.0	0.081	0.302
Average	10.1	39.6	101.1	1,833.0	0.086	0.304
Minimum	10.0	36.4	78.1	1,833.0	0.079	0.235
Maximum	10.3	45.1	113.5	1,833.0	0.098	0.344
Summation	212.4	830.6	2,124.1	38,493.0	1,798	3,366
Included Data Points	21	21	21	21	21	21
Total number of Data Points	21	21	21	21	21	21

F = Unit Offline E = Exceedance C = Calibration S = Substituted M = Maintenance T = Out Of Control
 Report Generated: 09/20/11 04:41 Report Version 3.0.0806

* = Suspect
 STACKVISION-SVR\plantadmin

B9 mid flow RATA

Run 1

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 06:55 Through 09/20/2011 07:01

Time Online Criteria: 1 minute(s)

Source	B9			
Parameter (Unit)	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHRS)
09/20/11 06:55	6,795,798.0	29.33	318	342.6
09/20/11 06:56	6,902,196.0	29.35	318	342.8
09/20/11 06:57	7,007,966.0	29.35	318	343.0
09/20/11 06:58	6,952,464.0	29.33	317	342.8
09/20/11 06:59	6,882,231.0	29.34	317	342.4
09/20/11 07:00	6,874,989.0	29.36	317	342.3
09/20/11 07:01	6,792,580.0	29.34	316	342.4
Average	6,886,889.1	29.34	317	342.6
Minimum	6,792,580.0	29.33	316	342.3
Maximum	7,007,966.0	29.36	318	343.0
Summation	48,208,224.0	205.40	2,221	2,398.3
Included Data Points	7	7	7	7
Total number of Data Points	7	7	7	7

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/2011 07:17

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATE
Run 2

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:02 Through 09/20/2011 07:07

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 07:02	6,705,795.0	29.35	315	342.4
09/20/11 07:03	6,763,172.0	29.36	313	342.5
09/20/11 07:04	6,754,747.0	29.35	312	342.5
09/20/11 07:05	6,734,239.0	29.34	310	342.6
09/20/11 07:06	6,824,488.0	29.35	309	342.4
09/20/11 07:07	6,824,069.0	29.33	309	342.2
Average	6,767,751.7	29.35	311	342.4
Minimum	6,705,795.0	29.33	309	342.2
Maximum	6,824,488.0	29.36	315	342.6
Summation	40,806,510.0	176.08	1,868	2,054.6
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 07:17

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Mid Flow RATA

Run 3

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:08 Through 09/20/2011 07:14

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 07:08	6,754,703.0	29.34	310	342.2
09/20/11 07:09	6,700,638.0	29.34	310	342.1
09/20/11 07:10	6,722,901.0	29.35	310	341.9
09/20/11 07:11	6,793,083.0	29.35	311	341.4
09/20/11 07:12	6,819,879.0	29.35	313	341.2
09/20/11 07:13	6,846,449.0	29.34	314	341.6
09/20/11 07:14	6,877,671.0	29.34	315	342.0
Average	6,787,874.9	29.34	312	341.8
Minimum	6,700,638.0	29.34	310	341.2
Maximum	6,877,671.0	29.35	315	342.2
Summation	47,515,124.0	205.41	2,183	2,392.4
Included Data Points	7	7	7	7
Total number of Data Points	7	7	7	7

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 07:18

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RTA
Run 4

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:25 Through 09/20/2011 07:30

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 07:25	6,921,372.0	29.37	313	341.3
09/20/11 07:26	6,882,388.0	29.36	313	341.5
09/20/11 07:27	6,799,664.0	29.36	313	341.4
09/20/11 07:28	6,809,929.0	29.37	314	341.4
09/20/11 07:29	6,781,422.0	29.37	315	341.2
09/20/11 07:30	6,725,566.0	29.36	315	341.1
Average	6,820,056.8	29.36	314	341.3
Minimum	6,725,566.0	29.36	313	341.1
Maximum	6,921,372.0	29.37	315	341.5
Summation	40,920,341.0	176.19	1,883	2,047.9
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 07:45

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 Mid Flow RATA
Run 5

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:31 Through 09/20/2011 07:37

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 07:31	6,788,450.0	29.36	315	341.1
09/20/11 07:32	6,874,075.0	29.37	316	341.2
09/20/11 07:33	6,805,416.0	29.35	315	341.3
09/20/11 07:34	6,794,836.0	29.38	316	341.3
09/20/11 07:35	6,873,605.2	29.38	314	341.4
09/20/11 07:36	6,839,839.0	29.37	315	341.5
09/20/11 07:37	6,801,675.0	29.37	314	341.4
Average	6,825,413.7	29.37	315	341.3
Minimum	6,788,450.0	29.35	314	341.1
Maximum	6,874,075.0	29.38	316	341.5
Summation	47,777,896.2	205.58	2,205	2,389.2
Included Data Points	7	7	7	7
Total number of Data Points	7	7	7	7

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 07:46

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATA

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:38 Through 09/20/2011 07:43

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9TEMP (DEGFAHR)
09/20/11 07:38	6,777,293.0	29.36	313	341.3
09/20/11 07:39	6,803,302.0	29.37	314	341.2
09/20/11 07:40	6,775,500.0	29.35	314	341.0
09/20/11 07:41	6,726,354.0	29.35	315	341.1
09/20/11 07:42	6,766,144.0	29.36	315	341.2
09/20/11 07:43	6,775,631.0	29.37	315	341.4
Average	6,770,704.0	29.36	314	341.2
Minimum	6,726,354.0	29.35	313	341.0
Maximum	6,803,302.0	29.37	315	341.4
Summation	40,624,224.0	176.16	1,886	2,047.2
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 07:47

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATA

Run 7

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 07:55 Through 09/20/2011 08:00

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 07:55	6,872,023.0	29.36	316	342.7
09/20/11 07:56	6,899,540.0	29.38	316	342.8
09/20/11 07:57	6,906,576.0	29.38	316	342.7
09/20/11 07:58	6,781,357.0	29.37	316	342.5
09/20/11 07:59	6,761,943.0	29.39	317	342.7
09/20/11 08:00	6,759,905.0	29.41	317	342.9
Average	6,830,224.0	29.38	316	342.7
Minimum	6,759,905.0	29.36	316	342.5
Maximum	6,906,576.0	29.41	317	342.9
Summation	40,981,344.0	176.29	1,898	2,056.3
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 08:23

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATA

Run 8

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 08:01 Through 09/20/2011 08:06

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 08:01	6,791,084.0	29.36	317	342.7
09/20/11 08:02	6,848,047.0	29.39	317	342.7
09/20/11 08:03	6,901,059.0	29.38	317	343.2
09/20/11 08:04	6,924,736.0	29.38	318	343.4
09/20/11 08:05	6,933,670.0	29.38	318	343.2
09/20/11 08:06	6,935,694.0	29.38	319	343.1
Average	6,889,048.3	29.38	318	343.1
Minimum	6,791,084.0	29.36	317	342.7
Maximum	6,935,694.0	29.39	319	343.4
Summation	41,334,290.0	176.27	1,906	2,058.3
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/2011 08:23

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATA

Run 9

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 08:07 Through 09/20/2011 08:12

Time Online Criteria: 1 minute(s)

Source	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 08:07	6,916,665.0	29.38	319	343.2
09/20/11 08:08	6,802,484.0	29.39	318	343.7
09/20/11 08:09	6,932,484.0	29.38	318	343.2
09/20/11 08:10	6,994,000.0	29.39	316	343.7
09/20/11 08:11	6,894,162.0	29.42	315	343.6
09/20/11 08:12	6,849,022.0	29.40	316	343.3
Average	6,898,136.2	29.39	317	343.5
Minimum	6,802,484.0	29.38	315	343.2
Maximum	6,994,000.0	29.42	319	343.7
Summation	41,388,817.0	176.36	1,902	2,060.7
Included Data Points	6	6	6	6
Total number of Data Points	6	6	6	6

F = Unit Offline

E = Exceedance

C = Calibration

S = Substituted

I = Invalid

M = Maintenance

T = Out Of Control

* = Suspect

Report Generated: 09/20/11 08:24

Report Version 3.0.0914

STACKVISION-

1 of 1

B9 mid flow RATA

Run 10

Average Data

Plant: Manitowoc Public Utilities

Interval: 1 Minute

Type: Roll

Report Period: 09/20/2011 08:13 Through 09/20/2011 08:19

Time Online Criteria: 1 minute(s)

Source Parameter (Unit)	B9			
	B9CPFLOW (SCFH)	B9PVAC (INCHESHG)	B9STEAM (KLBS/HR)	B9STEMP (DEGFAHR)
09/20/11 08:13	6,884,866.0	29.38	316	343.4
09/20/11 08:14	6,912,254.0	29.38	316	343.5
09/20/11 08:15	6,986,523.0	29.38	317	343.4
09/20/11 08:16	6,961,383.0	29.38	318	343.5
09/20/11 08:17	6,862,597.0	29.36	318	343.8
09/20/11 08:18	6,822,672.0	29.39	318	344.2
09/20/11 08:19	6,855,542.0	29.38	318	344.1
Average	6,897,976.7	29.38	317	343.7
Minimum	6,822,672.0	29.36	316	343.4
Maximum	6,986,523.0	29.39	318	344.2
Summation	48,285,837.0	205.65	2,221	2,405.9
Included Data Points	7	7	7	7
Total number of Data Points	7	7	7	7

F = Unit Offline

I = Invalid

E = Exceedance

M = Maintenance

C = Calibration

T = Out Of Control

S = Substituted

* = Suspect

Report Generated: 09/20/11 08:24

Report Version 3.0.0914

STACKVISION-

1 of 1

RATA Test - Part 75

Plant: MPU Source: B9

Parameter:	B9CPCO2	Unit of Measure:	PERCENT
Effective Date/Time:	09/20/2011 05:40	Test Number:	XML (X09-Q3-2011-001) / EDR (1)
Monitoring System ID:	X09	Test Result:	Passed
Test Reason:	QA-Periodic Quality Assurance	Overall BAF:	1.000
CEMS Time Offset :		Frequency:	4QTRS
Test Comment:			
Operating Level:	Low	APS Indicator:	False
Mean CEMS:	10.467	tValue:	2.306
Mean Reference:	10.300	Avg Load:	165
Mean Difference:	-0.167	Confidence Coefficient:	0.038

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:20	10.7	10.8	-0.1	172	Y
2	09/19/2011 23:35	09/19/2011 23:55	10.6	10.7	-0.1	169	Y
3	09/20/2011 00:10	09/20/2011 00:30	10.5	10.7	-0.2	168	Y
4	09/20/2011 00:45	09/20/2011 01:05	10.3	10.5	-0.2	166	Y
5	09/20/2011 01:20	09/20/2011 01:40	10.3	10.5	-0.2	164	Y
6	09/20/2011 01:55	09/20/2011 02:15	10.3	10.6	-0.3	165	Y
7	09/20/2011 02:30	09/20/2011 02:50	10.1	10.3	-0.2	161	Y
8	09/20/2011 03:10	09/20/2011 03:30	10.2	10.4	-0.2	164	Y
9	09/20/2011 03:45	09/20/2011 04:05	10.0	10.2	-0.2	162	Y
10	09/20/2011 04:20	09/20/2011 04:40	10.0	10.1	-0.1	160	Y

RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPFLOW

Effective Date/Time: 09/20/2011 05:30

Monitoring System ID: X03

Test Reason: QA-Periodic Quality Assurance

CEMS Time Offset :

Test Comment:

Operating Level: Low

Mean CEMS: 4,857,333.333

Mean Reference: 4,935,222.222

Mean Difference: 77,888.889

Flow/Load Ratio: 0.30

Heat/Load Ratio: 1710

Unit of Measure: SCFH
Test Number: XML (X03-Q3-2011-001) / EDR (1)

Test Result: Passed

Overall BAF: 1.016

Frequency: 4QTRS

Level BAF: 1.016

Relative Accuracy: 2.89

Standard Deviation: 84,322.957

Confidence Coefficient: 64,816.246

CO/O2 RM Used:

Reference Heat:

APS Indicator: False

tValue: 2.306

Avg Load: 165

Report in EDR: Y

Use BAF: Y

Reference Method: 2

Stack Dia:

Stack Area:

Default WAF:

Calculated WAF:

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:10	5,054,000.0	4,941,000.0	113,000.0	172	Y
2	09/19/2011 23:35	09/19/2011 23:45	5,086,000.0	4,863,000.0	223,000.0	169	
3	09/20/2011 00:10	09/20/2011 00:20	5,044,000.0	4,840,000.0	204,000.0	169	Y
4	09/20/2011 00:45	09/20/2011 00:55	4,988,000.0	4,849,000.0	139,000.0	166	Y
5	09/20/2011 01:20	09/20/2011 01:30	4,976,000.0	4,834,000.0	142,000.0	164	Y
6	09/20/2011 01:55	09/20/2011 02:05	4,909,000.0	4,863,000.0	46,000.0	166	Y
7	09/20/2011 02:30	09/20/2011 02:40	4,855,000.0	4,787,000.0	68,000.0	162	Y
8	09/20/2011 03:10	09/20/2011 03:20	4,943,000.0	4,871,000.0	72,000.0	164	Y
9	09/20/2011 03:45	09/20/2011 03:55	4,809,000.0	4,884,000.0	-75,000.0	162	Y
10	09/20/2011 04:20	09/20/2011 04:30	4,839,000.0	4,847,000.0	-8,000.0	161	Y

RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPFLOW

Effective Date/Time: 09/20/2011 09:19

Monitoring System ID: X03

Test Reason: QA-Periodic Quality Assurance

CEMS Time Offset :

Test Comment:

Operating Level: Mid

Mean CEMS: 6,839,333.333

Mean Reference: 6,758,000.000

Mean Difference: -81,333.333

Flow/Load Ratio: 0.21

CO/O2 RM Used:

Reference Heat:

Heat/Load Ratio: 1562

APS Indicator: False

Relative Accuracy: 2.06

Standard Deviation: 75,582.736

Confidence Coefficient: 58,097.930

Report in EDR: Y

Use BAF: Y

Reference Method: 2

Test Number: XML (X03-Q3-2011-002) / EDR (2)

Test Result: Passed

Overall BAF:

Frequency: 4QTRS

Unit of Measure: SCFH

Report in EDR: Y

Use BAF: Y

Reference Method: 2

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/20/2011 06:55	09/20/2011 07:01	6,716,000.0	6,887,000.0	-171,000.0		317 Y
2	09/20/2011 07:02	09/20/2011 07:07	6,668,000.0	6,768,000.0	-100,000.0		311 Y
3	09/20/2011 07:08	09/20/2011 07:14	6,693,000.0	6,788,000.0	-95,000.0		312 Y
4	09/20/2011 07:25	09/20/2011 07:30	6,648,000.0	6,820,000.0	-172,000.0		314 Y
5	09/20/2011 07:31	09/20/2011 07:37	6,834,000.0	6,825,000.0	9,000.0		315 Y
6	09/20/2011 07:38	09/20/2011 07:43	6,840,000.0	6,771,000.0	69,000.0		315 Y
7	09/20/2011 07:55	09/20/2011 08:00	6,721,000.0	6,830,000.0	-109,000.0		316 Y
8	09/20/2011 08:01	09/20/2011 08:06	6,773,000.0	6,889,000.0	-116,000.0		318 Y
9	09/20/2011 08:07	09/20/2011 08:12	6,751,000.0	6,898,000.0	-147,000.0		317 Y
10	09/20/2011 08:13	09/20/2011 08:19	6,826,000.0	6,898,000.0	-72,000.0		317 Y

RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPNOX

Effective Date/Time: 09/20/2011 05:40

Monitoring System ID: X06

Test Reason: QA-Periodic Quality Assurance

CEMS Time Offset :

Test Comment:

Operating Level: Low

Mean CEMS: 39.144

Mean Reference: 39.467

Mean Difference: 0.322

Unit of Measure: PPM
Test Number: XML (X06-Q3-2011-001) / EDR (1)
Test Result: Passed
Overall BAF: 1.000
Frequency: 4QTRS

Report in EDR: Y
Use BAF: Y
Reference Method: 7E

APS Indicator: False
tValue: 2.306
Avg Load: 166

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:20	35.0	34.8	0.2	172	Y
2	09/19/2011 23:35	09/19/2011 23:55	37.7	37.3	0.4	169	Y
3	09/20/2011 00:10	09/20/2011 00:30	40.4	40.8	-0.4	168	Y
4	09/20/2011 00:45	09/20/2011 01:05	38.3	37.1	1.2	166	Y
5	09/20/2011 01:20	09/20/2011 01:40	38.8	37.8	1.0	164	Y
6	09/20/2011 01:55	09/20/2011 02:15	41.1	41.2	-0.1	165	Y
7	09/20/2011 02:30	09/20/2011 02:50	41.6	41.5	0.1	161	Y
8	09/20/2011 03:10	09/20/2011 03:30	40.3	40.2	0.1	164	Y
9	09/20/2011 03:45	09/20/2011 04:05	42.0	41.6	0.4	162	Y
10	09/20/2011 04:20	09/20/2011 04:40	41.0	39.5	1.5	160	

RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9CPSO2

Effective Date/Time: 09/20/2011 05:40

Monitoring System ID: X01

Test Reason: QA-Periodic Quality Assurance

CEMS Time Offset :

Test Comment:

Operating Level: Low

Mean CEMS: 90.689

Mean Reference: 90.578

Mean Difference: -0.111

Unit of Measure: PFM

Test Number: XML (X01-Q3-2011-001) / EDR (1)

Test Result: Passed

Overall BAF: 1.000

Frequency: 4QTRS

APS Indicator: False

tValue: 2.306

Avg Load: 166

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:20	95.0	95.9	-0.9	172	Y
2	09/19/2011 23:35	09/19/2011 23:55	95.7	96.2	-0.5	169	Y
3	09/20/2011 00:10	09/20/2011 00:30	86.4	86.3	0.1	168	Y
4	09/20/2011 00:45	09/20/2011 01:05	93.2	93.4	-0.2	166	Y
5	09/20/2011 01:20	09/20/2011 01:40	88.9	88.2	0.7	164	Y
6	09/20/2011 01:55	09/20/2011 02:15	76.8	77.4	-0.6	165	Y
7	09/20/2011 02:30	09/20/2011 02:50	87.3	86.4	0.9	161	
8	09/20/2011 03:10	09/20/2011 03:30	90.3	90.0	0.3	164	Y
9	09/20/2011 03:45	09/20/2011 04:05	87.2	87.6	-0.4	162	Y
10	09/20/2011 04:20	09/20/2011 04:40	101.7	101.2	0.5	160	Y

RATA Test - Part 75

Plant: MPU Source: B9

Parameter: B9NOX#M
 Effective Date/Time: 09/20/2011 05:40
 Monitoring System ID: X05
 Test Reason: QA-Periodic Quality Assurance
 CEMS Time Offset :
 Test Comment:

Operating Level: Low
 Mean CEMS: 0.082
 Mean Reference: 0.085
 Mean Difference: 0.002

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:20	0.072	0.070	0.002	172	Y
2	09/19/2011 23:35	09/19/2011 23:55	0.078	0.076	0.002	169	Y
3	09/20/2011 00:10	09/20/2011 00:30	0.084	0.084	0.000	168	Y
4	09/20/2011 00:45	09/20/2011 01:05	0.081	0.077	0.004	166	
5	09/20/2011 01:20	09/20/2011 01:40	0.082	0.079	0.003	164	Y
6	09/20/2011 01:55	09/20/2011 02:15	0.088	0.086	0.002	165	Y
7	09/20/2011 02:30	09/20/2011 02:50	0.090	0.088	0.002	161	Y
8	09/20/2011 03:10	09/20/2011 03:30	0.087	0.084	0.003	164	Y
9	09/20/2011 03:45	09/20/2011 04:05	0.092	0.089	0.003	162	Y
10	09/20/2011 04:20	09/20/2011 04:40	0.090	0.086	0.004	160	Y

APS Indicator: False
 Relative Accuracy: 3.77
 Standard Deviation: 0.001
 Confidence Coefficient: 0.001

Test Result: Passed

Overall BAF: 1.028

Frequency: 4QTRS

Unit of Measure: #MMBTU
 Test Number: XML (X05-Q3-2011-001) / EDR (1)

Report in EDR: Y

Use BAF: Y

Reference Method:

RATA Test - Permit

Plant: MPU Source: B9

Parameter: B9SO2#M

Effective Date/Time: 09/20/2011 05:40

Test Result: Passed

CEMS Time Offset:

Test Comment:

Operating Level: Low

Mean CEMS: 0.263

Mean Reference: 0.268

Mean Difference: 0.005

Relative Accuracy: 2.41
Standard Deviation: 0.002
Confidence Coefficient: 0.002

APS Indicator: False
tValue: 2.306
Avg Load: 166

Run	Started	Ended	Reference Value	CEMS Value	Difference	Load	Use
1	09/19/2011 23:00	09/19/2011 23:20	0.271	0.270	0.001	172	Y
2	09/19/2011 23:35	09/19/2011 23:55	0.276	0.273	0.003	169	Y
3	09/20/2011 00:10	09/20/2011 00:30	0.250	0.246	0.004	168	Y
4	09/20/2011 00:45	09/20/2011 01:05	0.276	0.271	0.005	166	Y
5	09/20/2011 01:20	09/20/2011 01:40	0.262	0.255	0.007	164	Y
6	09/20/2011 01:55	09/20/2011 02:15	0.228	0.223	0.005	165	Y
7	09/20/2011 02:30	09/20/2011 02:50	0.263	0.255	0.008	161	
8	09/20/2011 03:10	09/20/2011 03:30	0.270	0.263	0.007	164	Y
9	09/20/2011 03:45	09/20/2011 04:05	0.265	0.260	0.005	162	Y
10	09/20/2011 04:20	09/20/2011 04:40	0.311	0.304	0.007	160	Y

APPENDIX I

PROCEDURES

Please Note: In an effort to conserve paper, the procedure section of the appendix has been reserved for explanations of EPA methodology deviations. Please refer to the specific EPA Methods on the following EPA website:

<http://www.epa.gov/ttn/emc/>

APPENDIX J

CALCULATION EQUATIONS

data; correct each wet CEMS run using the corresponding CEMS moisture monitor date using Equation 2-1.

$$\text{Concentration}_{\text{(dry)}} = \frac{\text{Concentration}_{\text{(wet)}}}{(1-B_{ws})} \quad \text{Eq. 2-1}$$

12.1.2 Correction to Units of Standard (as applicable). Correct each dry RM run to the units of the emission standard with the corresponding Method 3B data; correct each dry CEMS run using the corresponding CEMS diluent monitor data as follows:

12.1.2.1 Correct to Diluent Basis. The following is an example of concentration (ppm) correction to 7% oxygen.

$$\text{ppm}_{\text{(corr)}} = \text{ppm}_{\text{(uncorr)}} \left[\frac{20.9 - 7.0}{20.9 - \%O_2(\text{dry})} \right] \quad \text{Eq. 2-2}$$

The following is an example of mass/gross calorific value (lbs/million Btu) correction.

$$\text{lbs/MMBtu} = \text{Conc}_{\text{(dry)}} \text{ (F-factor)} \ (20.9 / 20.9 - \%O_2)$$

12.2 Arithmetic Mean. Calculate the arithmetic mean of the difference, d , of a data set as follows:

$$\bar{d} = \frac{1}{n} \sum_{i=1}^n d_i \quad \text{Eq. 2-3}$$

where:

n = Number of data points.

$\sum_{i=1}^n d_i$ = Algebraic summation of the individual differences d_i .

12.3 Standard Deviation. Calculate the standard deviation, s_d , as follows:

$$s_d = \sqrt{\frac{\sum_{i=1}^n d_i^2 - \left(\frac{\sum_{i=1}^n d_i}{n}\right)^2}{n-1}} \quad \text{Eq. 2-4}$$

12.4 Confidence Coefficient. Calculate the 2.5 percent error confidence coefficient (one-tailed), CC, as follows:

$$CC = t_{0.975} \frac{s_d}{\sqrt{n}} \quad \text{Eq. 2-5}$$

where: $t_{0.975}$ = t-value (see Table 2-1).

12.5 Relative Accuracy. Calculate the RA of a set of data as follows:

$$RA = \frac{[|\bar{d}| + |CC|]}{RM} \times 100 \quad \text{Eq. 2-6}$$

where:

$|\bar{d}|$ = Absolute value of the mean differences (from Equation 2-3).

$|CC|$ = Absolute value of the confidence coefficient (from Equation 2-3).

\overline{RM} = Average RM value. In cases where the average emissions for the test are less than 50 percent of the applicable standard, substitute the emission standard value in the denominator of Eq. 2-6 in place of \overline{RM} .
In all other cases, use \overline{RM} .

13.0 Method Performance.

13.1 Calibration Drift Performance Specification.

The CEMS calibration must not drift or deviate from the reference value of the gas cylinder, gas cell, or optical filter by more than 2.5 percent of the span value. If the CEMS includes pollutant and diluent monitors, the CD must be determined separately for each in terms of concentrations (See Performance Specification 3 for the diluent specifications), and none of the CDs may exceed the specification.

13.2 Relative Accuracy Performance Specification.

The RA of the CEMS must be no greater than 20 percent when \overline{RM} is used in the denominator of Eq. 2-6 (average emissions during test are greater than 50 percent of the emission standard) or 10 percent when the applicable emission standard is used in the denominator of Eq. 2-6 (average emissions during test are less than 50 percent of the emission standard).

MSI / Manitowoc PU
Test 1N Run 5
Sample Calculations

LB/mmBtu	
Calculator	<i>Equations - CFR 40, Part 60, Method 19</i>
SO ₂ : Calculator	SO₂ : Equations SO ₂ ppm,w = 88.87 CO ₂ %,w = 19-7 F-factor (F _c) = Using the wet SO ₂ and CO ₂ numbers. lb/million Btu = 10.32 $F_c = 0.00000002595 * 64 * 100 * SO_2 \text{ ppm (wet)} / CO_2 \% \text{ (wet)}$ 1833 0.282153273
NO _x : Calculator	NO_x : Equations NO _x ppm,w = 38.83 CO ₂ %,w = 19-7 F-factor (F _c) = Using wet NO _x and CO ₂ numbers. lb/million Btu = 10.32 $F_c = 0.00000002595 * 46 * 100 * NO_x \text{ ppm (wet)} / CO_2 \% \text{ (wet)}$ 1833 0.08232758